PC MAGAZINE

**FREE PROGRAM:
POP-UP ASCII TABLE**

Power Graphics For Business

- 44 Programs
  that Supercharge
  Your Spreadsheet
  Graphics

- Animation Made Easy

- Eye-popping PC Slides:
  Lower Cost, Higher Quality

If only there were

Wouldn't it be great if you could multiply yourself? Do an honest day's work before lunch?

Well, you can. With Microsoft® Windows. Windows lets you work with multiple applications at the same time. With more programs, in fact, than your PC's memory can normally hold. Neatly sidestepping the 640K limit.

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Then you can select information from several different programs. Collect, combine, edit it all in one place. And print it all on a single piece of paper.

The whole process is easy, swift, and natural.

PC MAGAZINE

Created with LOTUS Freelance Plus

Freelance Plus on display, page 172.

Charting a Course Through Graphics Software

Cheryl J. Goldberg and Gerard Kunkel/Graphics have always added power to presentations. What's new is that business users everywhere are beginning to use graphics software to harness this power to analyze and communicate data effectively. But the market is still relatively new, and products can run the gamut from the best and the brightest to the defective and the dull. To help you make sense of this evolving market, *PC Magazine* has devoted this entire issue to graphics software. 113

Wipes, Pans, and Fade-outs: Animating Your Business Graphics

Winn L. Rosch/Images created with charting packages may no longer be enough to hold the attention of jaded viewers— you may have to go that extra mile with presentation graphics packages: *Show Partner*, *PC Storyboard*, *Concorde*, *ExecuVision*, and *Executive Picture Show* add impact with special effects such as animation. 247

Show Partner spices up your presentations with animation, page 249.

Graphics Software on Display

Cheryl J. Goldberg and Gerard Kunkel/Do you need graphics simply to analyze data? Or do you prefer a program with which you can create supersophisticated graphics presentations to wow audiences? Your answer will determine whether you should choose a dedicated charting program or an integrated package. We review 44 products, grouping them into four categories: those priced under $100, from $100 to $499, and $500 and over and integrated packages. 119

Specialized Graphics Software: The Quick and Clean Solution

Glenn Hart/You might be doing yourself a disservice if you're relying on general-purpose graphics packages to meet your specialized business needs. To create really effective Gantt charts, flowcharts, and text-only charts, you'll need the power of specialized graphics packages like *Diagram-Master*, *Diagraph*, *EasyFlow*, *MonoGrafx*, *OrgPlus*, and *Sign-Master*. 273

Producing Quality Output: When Only the Best Will Do

Robin Raskin/The best way to achieve professional-quality presentations is to use 35mm slides. But how do you turn your graphics creations into these high-resolution images? Film recorders and slide service bureaus are two options. 289

●Three New Film Recorders
Winn L. Rosch/Securing data from prying eyes, fast turnaround time, and long-term savings are three good reasons to invest your dollars in the ImageMaker, the Polaroid Palette Plus, or the PhotoMetric 200PC—all film recorders that can produce slides from images made with graphics software. 293

●The Service Bureau Option
Robin Raskin/Our survey of slide service bureaus turns up a number of companies that provide efficient service, high-quality output, and a reliable alternative to purchasing your own film recorder. 311

WHAT'S INSIDE

Gerard Kunkel and Cheryl Goldberg

To hear some of the purveyors of presentation graphics tell it, analytical graphics is a dirty word. But the fact remains that for most people, the moving images, musical beeps, and sequenced dissolves that characterize presentation graphics don't matter. What most business users want is a program that lets you put numbers into a computer and get pictures out.

Most of the 44 graphics programs reviewed in "Graphics Software on Display," starting on page 119, allow you to do just that. But there were exceptions. As Cheryl Goldberg, the associate editor in charge of our story, recalls, one of the programs nearly reduced a reviewer to tears. Apparently designed to work on a mainframe and then ported over to a PC, this program's user interface was unfathomable to everyone in PC Labs. At this point in What's Inside, we usually insert a pithy quote from a reviewer, but everything that normally easygoing writer Phil Wiswell said that is publishable is in his review.

At the other end of the spectrum, we found a program that's so easy to use, it can graph anything any program puts on-screen—even the file sizes of your directories. We don't know why you'd want to do this, but you can.

"Such power at your fingertips is a real temptation," according to our technical art director, Gerard Kunkel. "Users get the urge not only to graph everything but to put everything in the graph—icons of football players, smiling puppies, trucks whizzing along the interstate, and pork bellies superimposed on a rising graph of commodities futures." Kunkel, who along with Goldberg and the Labs devised the testing scenario for this issue, warns that the image libraries supplied with many graphics programs can't make you an artist, even though that's the implication. Besides, if you wanted to give in to temptation, you should have bought an Apple.

The big surprise here was that unlike word processors, databases, communications programs, and spreadsheets, there are no rock-bottom bargains: you can't get full-featured performance for less than $200. However, all three Editor's Choice graphics programs are priced in the midrange of $395 to $495.
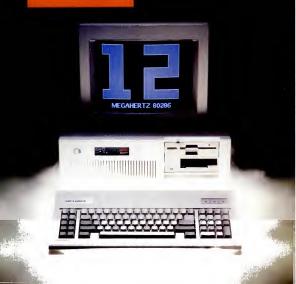
While they're the mainstream, analytical and dedicated charting packages aren't the whole graphics universe. In this special issue, *PC Magazine* also reviews other graphics categories: animated presentation packages, sign makers, organization chart makers, and flowchart programs. And in "Producing Quality Output: When Only the Best Will Do," page 289, we take you from disk files to ultra-high resolution (4,000 lines per inch) boardroom-quality slides and overhead transparencies.

The 12-megahertz 286[12] and 8-megahertz 286[8] come complete with a 1.2 megabyte floppy disk drive, 1,024K of high-speed RAM, 200-watt power supply and an AT-style keyboard.

Both feature SmartVu™, an alphanumeric LED panel that's a window on your world of computing, a look into the heart of the computer, reporting operating speeds and diagnostic messages in understandable English.

The 286[8] and 286[12] have been created by the best team of computer-hardware designers in the business. A totally new motherboard, custom ROM BIOS and proprietary circuits have been developed for this high-performance computer environment. And *every* 286[8] and 286[12] is bench-tested and run through an extensive burn-in before shipment.

PC's Limited was the first direct-response marketer to offer high-quality, low-priced PC-AT compatibles. PC's Limited has been a leader in pushing high-performance personal computing through price barriers. The experience gained from selling and supporting thousands of high-performance PCs to customers ranging from Fortune 500 companies to solo users has been applied to designing the most advanced personal computers ever produced: the PC's Limited 286[8] and 286[12].

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Twelve megahertz or eight megahertz . . . the choice is yours. *In high-performance computing, the choice is clear: PC's Limited.*

ALSO CONQUERS SPACE.

One Program

charts, symbols diagrams, etc., etc.

overheads & slides, too.

The Report Card on Alpha Corporation

1) People
2) Products
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4) Growth
5) Profits

SAMPLE KEYBOARD

Automotive Products

LETTERS TO PC MAGAZINE

AN ASSEMBLY DEBATE

I believe that Bill Machrone's column "The Death of Good Software" (From the Editor's Screen, PC Magazine, Volume 5 Number 20) was way off the mark. Although Mr. Machrone makes several good points, he fails to recognize the opposing arguments.

Why wasn't MicroPro able to come up with competitive enhancements to Word-Star, Version 3.3? I'll wager that it was precisely because they wrote the product in assembly code. Assembly code is inherently unmaintainable once the original programmer has left the company. Mr. Machrone confuses corporate confusion and dubious judgment at MicroPro with the issue of assembly language versus high-level language.

Warren Sirota
Oakland, California

The only "inherently unmaintainable" code is sloppy, poorly commented spaghetti code—in any language. Much of WordStar's code happens to be so good that legions of nonprofessional programmers have been able to tweak lots of extra performance and features from it.—Ed.

I am responding to your recent editorial, "The Death of Good Software" (From the Editor's Screen).

WordPerfect was originally written in 1980 for a Data General C/300. At that time, we had to be very frugal with memory and cycles so that the accounting department wouldn't complain when WordPerfect was added to its system. Consequently, we wrote the program in assembly, and it ran in less than 64K bytes of RAM (40K bytes were shared code).

When we started work on the PC ver-

sion, we looked at C seriously. The decision we made to use assembly again wasn't very difficult, since there wasn't a mature version of C on the market in March 1982.

Today we are extremely glad we didn't go to a higher-level language. Our memory requirements are generally lower than those of our competition, and we're generally faster even though we do a lot more formatting on the screen than other word processing products. I admit that we are working on a C version for machines like the NCR Tower, but most of our software will continue to be written in assembly. We will not stop writing "tight, well-written code." I admit that an assembly programmer is part of a dying breed, but at least a few are alive and well.

W. E. Pete Peterson
Executive Vice President
WordPerfect Corp.
Orem, Utah

386: THE JAGUAR OF PCs

Your recent issue on the new 386 machines ("Compaq Leads the Way to Speed and Compatibility" and "Intel's 32-bit Wonder: The 80386 Microprocessor," PC Magazine, Volume 5 Number 20) prompted me to write down the following thoughts on the current state of technologi-

cal development in the computer industry:

After having the pleasure of trying out the Compaq Deskpro 386, it occurred to me that owning this machine is like owning a Jaguar. You have a car that can cruise comfortably at 160 mph, but the street system (DOS) is designed for 30 mph. For me, owning a 386 in the foreseeable future will be a frustrating experience. In fact, the 386 salesman told me that the only people buying the new machine now are those who have large databases or who use CAD/CAM systems (the Grand Prix drivers of the industry).

With the advent of the 386 technology, I would hope that software and hardware developers will switch from building features for Volkswagens to building those for modern fuel-efficient cars with many easy-to-use, convenient gadgets that make driving a pleasant experience.

So instead of buying that new Jaguar 386, I am prepared to stay with my old beater or wait until the computer industry produces a useful product that takes full advantage of the 386's speed and memory capacity. If Chrysler could figure this out, I would expect the same from the folks in Silicon Valley.

Grant Wichenko
Winnipeg, Manitoba
Canada

Bill Howard replies:
The Deskpro 386 gives you superhigh performance today—twice the speed of an AT (and five times that of a PC)—for a bit more money than for an AT. The 386 lacks only the planned obsolescence of so many other less-forward-looking machines.

Even with their current attention to engineering and quality control, Jags are good for only 140 mph.

■ LETTERS

MOUSE WON'T DO WINDOWS

While looking through the November 25, 1986, issue, I read your reference on the Microsoft Mouse (First Looks, page 59, *PC Magazine*, Volume 5 Number 20), and thought you might be interested to know that there is a bug in this version that prevents Microsoft Windows from booting up. After discovering this conflict, I called Microsoft and they sent me a new driver that fixed the bug.

Bill Lewis
Fort Worth, Texas

The "bug" you discovered is actually a lack of compatibility between the Microsoft Mouse, Version 6.0, and Microsoft Windows, Version 1.01. According to Microsoft, the correct mouse driver to accommodate the new InPort chip used with the Mouse 6.0. However, the latest release of Windows, Version 1.03, does have the proper driver to run with the Mouse. Microsoft suggests that users of both Windows 1.01 and the Mouse 6.0 either upgrade to Windows 1.03 or request the new mouse driver, as in Mr. Lewis's case. Microsoft will ship the driver at no charge to registered users.—Ed.

VICTOR MISSED THE BOAT

Your friend Victor has missed the boat (Stephen Manes), *PC Magazine*, Volume 5 Number 21). The big software companies have always convinced us to buy second, third, and fourth programs—all with the same name as the first.

The day I read Victor's advice, I got a letter from Microsoft. Finally, I thought, they're going to tell me why *Microsoft Word*, Version 3.0, doesn't run correctly on my dual-floppy disk, 256K-byte IBM PC. How naive can one be!? Of course, Microsoft's letter was not in response to my inquiry, but a sales pitch for *Word*, Version 3.1. Ever *PC Magazine* can't keep up with the versions, for you reviewed the now-outdated *Word* 3.0 in the same issue ("Triple Crown: New Editions of Three Winning Word Processors").

Perhaps Victor would like to wager some of that venture capital on whether the original problems were fixed with this latest version, or on whether Microsoft will answer my letter before the next version of

Word appears. C'mon, Victor! Since your venture has already been anticipated, you need something to do with that money.

J. R. Myers
Baltimore, Maryland

SQUARENOTE SQUARED AWAY

While it may be a bit ungracious to nitpick about a review in which our product was an Editor's Choice ("TBMS: Database Power Unleashed," *PC Magazine*, Volume 5 Number 20), the review of our *SquareNote* seems to imply that it is incapable of any type of Boolean search. In fact, as it is primarily a keyword-oriented system, *SquareNote* provides Boolean selection on keywords as its main retrieval strategy.

We'd also like to mention that the review was based on an earlier version than the one we're currently shipping, which has instantaneous help screens and improved import and export.

Lucy A. Lynch
Union Squareware
Somerville, Massachusetts

READING BETWEEN THE LINES

I read with great amusement Stephen Manes's egocentric column entitled "You Get What You Pay For?" (*PC Magazine*, Volume 5 Number 21). Though it was written in the hypothetical, it was not difficult to read between the lines.

As a potential user of SquishySoft's *MaxiTool*, I was delighted to see just how far a contributing editor of *PC Magazine* is willing to go to assist the software industry in improving its offerings to the public. After all, we can't have writers, lawyers, and so forth, who hold the public trust, volunteering their time to improve the general welfare. Imagine, if any writer for *PC Magazine* (all of whom are regarded as experts in the field) were to help a software publisher while he was trying to develop an application, it might work correctly the first time. Then where would we be? Why, there would be no more reviews with snide comments about how inadequate a new re-

lease is, and no more editorials on how disappointing the software industry is as a whole.

Then the next thing you know, we'll have renowned biochemists giving away their patent rights to polio vaccines for only a dollar (which is an excellent example of getting what you pay for). Just think of the millions of people who are still waiting to receive what they paid for from Dr. Jonas Salk's uncompensated time.

Thomas S. Danford
Orlando, Florida

Stephen Manes replies:

Everybody on this publication's masthead has spent hundreds of hours gladly proffering free advice. But there's a limit: presentation graphics programs are not quite in the same league as polio shots.

If the altruistic Mr. Danford seriously believes Dr. Salk did his pioneering work after-hours on weekends in his dank, candlelit basement lab without financial compensation of any sort, perhaps he'd be interested in purchasing this home for a rare cherrywood fragment hewn by the young George Washington. Nah! On second thought, he'd probably want it for free.

A PIECE OF MY MIND

In his column "What's on Steven Jobs's Mind?" (*PC Magazine*, Volume 5 Number 20), Stewart Alsop claims that everyone will want a desktop publishing system in a few years. He stops just short of implying that these will be the only personal computers available at that time!

I would like to say that if anyone attempts to saddle me with such a system I will walk straight out the door. The last thing that businesses need and want for the majority of their employees is to have them waste time worrying about the physical appearance of the printed page. Yes, desktop publishing is great for people responsible for producing newsletters, or reproduction? I sincerely hope not.

Warren Sirota
Oakland, California

Stewart Alsop replies:

Mr. Sirota misunderstands what I was trying to say (probably because I could have said it better). The true significance of desktop publishing is not so much the abili-

ty to create designed documents that appear to have been professionally produced and typeset. I don't use a page composition program at all, but I do use fonts, highlighting, and laser printers. None of this slows down my computer or my work; all of it helps other people understand what I'm saying. Indeed, the significance of desktop publishing is that it makes all documents—sales reports, financial forecasts, rough drafts, memo—communicate more effectively. I'm sure that Mr. Sirota needs to communicate effectively on his job, and if, as I speculated in my column, he were able to enhance his documents on-screen and then deliver them without modification, his effectiveness as a communicator would be improved. Since most of our work involves communicating with other people, that would seem to me to be the first thing that businesses would want their employees to worry about.

CORRECTIONS/AMPLIFICATIONS

In the sidebar "Tales of Many LANs" ("Connectivity LANs and Beyond," *PC Magazine*, Volume 5 Number 21, page 120), the line "McGill has six of Standard Microsystems Corp.'s ARCnet LANs . . ." should read "McGill has six of Pure Data's PC150B ARCnet LANs . . ."

The correct address for Pro/Tem Software, maker of *Notebook II* ("TBMS: Database Power Unleashed," *PC Magazine*, Volume 5 Number 20), is 814 Tolman Dr., Stanford, CA 94305.

HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion on paper or disk to Letters to PC Magazine, One Park Avenue, New York, NY 10016, or send your opinion through MCI Mail to PCMAGAZINE at address 157-9301. We're sorry we're not able to answer letters personally.

All letters become the property of *PC Magazine* and are subject to editing. We publish letters that do not include a name, address, and phone number for verification.

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GREENLEAF FUNCTIONS
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C source, assembler source, and binary libraries of 225 functions for many compilers. Emphasizes tight functional program to maximize loading code which your application may never use. Manual helps select functions, build on board, too.

A sampling: DOS extensions for file and directory manipulation. Screen to select mode, page, monochrome or color palette, cursor shape, positioning, clearing and scrolling, pixel get and put, read light pen (Sensor ready), etc. efficient int operations which add, delete and string pointers to top speed. Other graphics character primitives: keyboard status, function key assignment, time/date and requests and memory size peek and poke. Manual free-seller Specify 8070 & Compiler. List **$95** Here **$139**

GREENLEAF COMMUNICATIONS
Hello World

Want your application to communicate with other users or remote data lines by asynchronous communications line? right are your C programs? Even if you don't need a new that is a skill to have at the ready!

120 functions and demo programs in both C and assembler source code set up separate transmit and receive ring buffers for up to 18 simultaneous channels. It simply drives so you can halt an incoming record, display it, file it, let the user edit it then continue. Goodbye separate communications software.

Supports up to 9600 baud ASCII or binary, any parity or word length. 8250 UARTS. Ron XON and Xmodem, WriteTrack service. Specify 8070 & Compiler. List **$85** Us **$139**

INTERACTIVE-C
Compiler-Compatible Interpreter, Editor, Debugger

Easier C interpreters were miracles that compromised. Interactive C shows how far C interpreters have come. More than an interpreter, Interactive-C is a fully-integrated development environment: a complete K&R interpreter bound tightly to its own editor and debugger.

Slice through programming projects like a hot knife through butter. Enter new error-checking syntax, immediate detection of program misbehavior. State of the art debugging tools include breakpoints, watchvalues are real stepping options and interactive viewing and modification of variables. An Interactive C exclusive lets you interrupt to edit and continue from where you left off. Eliminates plaintext replays of already debugged code the tail end chaos of other interpreters.

Operate Interactive C using either alone edit command and menus run down. Toggle a second screen show an only you a program's output never any crowded unnecessary. Or boost productivity with two CRTs. Load object code of functions you have already compiled. Or of commercial libraries. Interactive C has immediate mode syntax checkout both as you type and run, and runs portions precisely posing at an error, not possible with incremental or pseudo-compilers which leave source code behind!

IBC: compiler-compatible right down to header files and library calls. Port programs between Interactive-C and your compiler with no modifications whatever -- not even bytes areas of dynamic memory allocation and I/O Specify 8086 & Compiler. List PC Board 1386 & Compiler **$249** **$319**

DAN BRICKLIN'S DEMO PROGRAM
Storyboard Your Program

The legendary One has created Metaphor Two when the rest of us are still on Zero Dan's fire was the original electronic note achiever (VisiCalc™). The one is for programmers.

Words don't express program ideas because programs are screens! Dan's Demo creates side shows. Create a screen -- a snapshot of your planned product as a run. Anything goes: words borders, box rules, reverse and underlining of monochrome tone and background color Copy that -- nuts to an empty screen. Change it a line, to show the next screen of run new Do it again. Freeze a whole slide show of our program in a snap.

At 256 characters and program are available from intellisate. ask which point to the screen. As commands are viewed in Lotus-style pop-up menus. Frequent choices mapped to function keys as well.

80x25 character mode: not bit-mapped. Screen areas can be blocked for cut and paste or filled with color or characters, even blank. Slides can overlay or others, can be shuffled deleted. Slides can proceed at time intervals or branch anywhere in the slide sequence depending on user keystroke.

Invaluable to prototype the program you are about to write, to present the same slide choose the color demos smoothe out the improvise interface. Or load the capture many and snapshot the screens of any run using program for an instant slide show!

Each copy entitles you to redistribute fifty of the slide presentive programs that runs demos. Plan manual, no harder keeps price of top product small. Might become the essential tool in user interface prototyping! Both licence! Ask for NICLE List **$75** US **$69**

BASTOC
OPTIMIZES!
Translates BASIC Into C

For a rolling press, BASTOC™ moves functionally of BASIC code over to C to a translator which takes a Microsoft Extended BASIC and emits pure K&R C (or Lattice 3.0 it will optionally) convert your program into a single monolithic C function or decompose it into separate functions, one for each OSSUB label!

Version 2's optimization dramatically reduces execution time. Converts to an leaves those variables of BASIC programs which do not need floating point. Where BASIC uses full segment statements to implement structure, BASTOC converts to C's compact form Simple dynamically allocated labeling your application of BASIC's constructs labels for garbage collection. Creates structure of own convoluted BASIC code. Huge workhorse! Ask for PC Board 80373 **$399**

Shopping List for the Power Workbench

ASSEMBLERS & DEBUGGERS	LIST	US
Advanced Trace-86 Morgan, ASM Interpreter	175	118
Codesmith-86 Debugger by Visual Age	145	99
CSD Debugger C source level by Mark Williams	75	55
C-Sprite Debugger by Lattice, source level	175	139
Microsoft Macro Assembler with Utilities	150	108
PASM86 by Phoenix, Macro Assembler	195	125
Periscope I Debugger Data Base Decisions	295	235
Periscope II Data Base Decisions	129	89
Periscope II-X software only	115	74
PfixB6 Plus by Phoenix, Symbolic Debugger	395	239

BASIC LANGUAGE		
BetterBASIC Summit Software	195	165
BetterBASIC Utilities 8087 Math Support	99	85
Bitwise Interface	99	85
Run Time Module	250	225
Microsoft BASIC Interpreter for XENIX	350	295
Microsoft QuickBASIC Compiler full MSDOS	99	79
Professional BASIC by Morgan	99	88
Run BASIC True BASIC Inc.	150	99
Run Time Module	150	99
True BASIC Libraries Strwan, Asyn, Sort, etc.		Call

C COMPILERS		
C-86 Compiler Computer Innovations	395	240
Lattice C Compiler from Lattice	500	299
Let's C Compiler by Mark Williams	75	55
with CSD Source Level Debugger	150	105
MWC-86 Mark Williams C Development	495	369
Microsoft C Compiler 4.0	450	265

C INTERPRETERS		
C-Terp by Gimpel Software	300	240
Instant C by Rational Systems	500	365
Interactive-C by IMPACC with debugging	249	219
RUN/C Professional from Lifeboat	250	185
RUN/C without Lauderate Lifeboat	120	100

TEXT EDITORS		
Brief from Solution Systems	195	Call
Edix by Emerging Tech. Multi-screen	195	159
Epsilon by Lugaru Software, like EMACS	195	148
FirsTime by Spruce Technology, C syntax	295	229
Kedit by Mansfield, similar to Xedit	125	99
LSE, the Lattice Screen Editor Multi Window	125	100
Pmate by Phoenix, with Macros	195	115
Text Management Utilities Grep, splat, diff, etc.	120	100
Vedit+ by Compuview	185	149
Vedit Plus by Compuview	185	129

FILE MANAGERS		
Btrieve by Softcraft, no royalties	250	195
Btrieve/N Network by SoftCraft	595	465
C Tree by FairCom -no royalties, source	395	329
B Tree by FairCom Report Generator	295	245
C Tree & B Tree Combo by FairCom	650	544
dBC-dBASE IIIa interface from Lattice	250	185
with source	500	360
dbVista single user DBMS by Raima	195	130
with source	495	329
dbVista multi-user DBMS	495	395
with source	990	695
Opt-Tech Sort Can! Btrieva files	149	145

SCREEN DESIGN		
Cursas by Lattice, UNIX screen designer	125	99
with source	250	185
Greenleaf Data Windows	225	169
with source	395	297
source purchased later	225	171
On-Line Help from Opt-Tech Data	149	145
Panel by RoundHill, no royalties	295	229
Panel Window Multi 1.0 by Roundhill	495	399
Vitamin C by Creative Programming	225	169

WINDOWS		
Windows for C Connect Creative Software	195	149
Windows for Data includes Windows for C	395	258
ZView Data Management Consultants	245	175

GRAPHICS		
Essential Graphics by Essential, no royalties	250	210
GSS Graphics Development Toolkit	495	375
GSS Kernel System by Graphic Software	495	375
GSS Kernel System for IBM RT	795	595
GSS Metafile Interpreter	295	235
GSS Plotting System	495	375
Halo by Media Cybernetics	300	219
with Bc Halo II	440	299
Halo for Microsoft includes all fonts	595	434

COMMUNICATIONS		
Asynch Manager by Blaise, for C or Pascal	175	125
Greenleaf Communications by Greenleaf	185	139
PTel by Phoenix, Binary File Communicator	195	118
Software Horizons Pack 3	149	119

UTILITY LIBRARIES		
Blaise C Tools Plus	175	125
Blaise C Tools	125	92
Blaise C Tools 2	100	68
C Food Smorgasbord by Lattice	150	108
C Utility Library by Essential, 300 functions	185	139
Greenleaf Functions by Greenleaf Software	185	139
PforCe by Phoenix, vast library	395	235
Software Horizons Packages	149	119
TopView Tool Basket by Lattice, source avail.	250	199

DEVELOPMENT TOOLS		
Code Sifter by David Smith Software, Profiler	119	89
C-Worthy by Custom Design Systems	295	249
C-Worthy for Network Manus, help, errors	495	449
Dan Bricklin's Demo Program Prototyper	75	69
LMK from Lattice by Lattice, "make" like UNIX	195	149
Microsoft Window Development Tools	500	365
PC Lint by Gimpel Software, after UNIX's "lint"	139	125
Pfinish by Phoenix, EXE performance analyzer	395	235
Plink86 Plus Utilities memory for overlays	495	315
Pmaker by Phoenix, like UNIX "make"	125	85
Pre-C by Phoenix, UNIX "lint" +Irks	295	195
Ptools by ParGraph products	895	679

OTHER TOOLS		
BASTOC by JMI, convert BASIC to C	495	399
BASIC-C BASIC's functions added to C	175	139
The HAMMER by GES Systems	195	149
Report Option by Softcraft, Btrieve Report Gen.	145	128
Xtrieve by Softcraft, Query Utility for Btrieve	245	220

FORTRAN COMPILERS & UTILITIES		
ACS Time Series by Alpha Computer Service	495	455
Forlib Plus by Alpha Computer Service	70	61
Microsoft FORTRAN Links with Microsoft C	350	219
Microsoft FORTRAN for XENIX	595	548
RMFORTRAN by Ryan McFarland	595	Call
Scientific Subroutine Package by Alpha	250	239
The Statistician by Alpha Computer	295	239
Strings & Things by Alpha Computer	70	65

OTHER LANGUAGES & UTILITIES		
Microsoft COBOL Compiler	700	499
Microsoft COBOL Compiler for XENIX	995	795
Microsoft COBOL Tools with Source Debugger	350	259
Microsoft COBOL Tools for XENIX	350	333
Microsoft Lisp View Common Lisp	250	169
Microsoft MuMath includes MuSimp	300	199
Microsoft Pascal Compiler Links with M soft C	300	199
Microsoft Pascal Compiler for XENIX	695	546
PDisk Phoenix's new disk manager	150	115
RM/COBOL by Ryan-McFarland	950	Call
RM/COBOL 85 ANSI 85 COBOL	1250	Call
Source Print Aldebaran's programmer	139	105

■ **GUS VENDITTO**

PC ADVISOR

Help in finding the right input device for drawing on your PC and in keeping file fragments in contiguous sectors on your hard disk.

DRAWING WITHOUT A MOUSE

I like the idea of doing sketches on my PC, and so I bought a mouse with *PC Paintbrush* (from Z-Soft Corp.). The woman who sold it to me drew a beautiful picture with it, but I just can't. Can you give me advice on other input devices? Basically, I want something like a light pen that I can draw with, but I don't see many around.

Charles Dai
Richmond, British Columbia
Canada

It's not a light pen you want—they're really appropriate only for making selections from a display by touching the pen to the monitor. You want a digitizer pen, which has the right shape for detailed sketching. There are two I can recommend.

Penmouse Plus (Kurta Corp., Phoenix, Ariz.; (602) 276-5533; $295) is cordless. It uses radio waves to send signals from the pen to an 8½- by 11-inch digitizing tablet; the tablet connects to a PC serial port. Since it can emulate the Microsoft Mouse, Penmouse Plus will run PC Paintbrush and a wide range of programs also compatible with the Microsoft Mouse.

More-detailed drawings are possible with SummaSketch (SummaGraphics, Fairfield, Conn.: (203) 384-1344; $595), which connects to a digitizing tablet via wire. Because it doesn't house a radio transmitter, it's lighter than the cordless Penmouse Plus. Also to be considered: it inputs at a resolution of 1,000 dots per inch (Penmouse Plus works at 200 dpi), so you can have more highly defined drawings (some people prefer a lower dpi because it's more forgiving; higher resolution demands higher accuracy). SummaSketch won't emulate a mouse but comes with a four-button cursor that does.

AVOIDING FILE FRAGMENTATION

When I used only floppy disks, I used to check them from time to time with CHKDSK *.* to determine if segments were contiguous. When a disk had more than five noncontiguous segments, I would copy to another disk and reformat. I was advised that this was the way to handle fragmentation. I can't get the same effect on my new hard disk. Perhaps fragmentation is not a problem on the hard disk.

Leonard Nadler
College Park, Maryland

File fragmentation is even more of a drag on access speed on a hard disk. Disk Optimizer (Soft Logic Solutions, Manchester, N.H.; (800) 272-9900; $59.95) was the

■ *Power Tools offers not only disk optimization but individual file defragmentation as well. It also includes a file finder.*

first utility created to solve the problem, and it's still the most popular.

A newer product offers not only disk optimization but individual file defragmentation as well. It's called Power Tools (MLI Microsystems, Framingham, Mass.; (617) 879-2000; $55), and in its bag of tricks it also includes utilities for file modelletion and a file finder. People who don't want to be bothered with the mechanics of their hardware are best served by Disk Optimizer, but since you seem to be highly attuned to your PC's health you'd probably be better off with Power Tools.

TAKING A MEGABYTE OUT OF THE ADVISOR'S CREDIBILITY

In your column on 3½-inch drives (Volume 5 Number 21), your reply states that the drives are rated at 720 megabytes. I know this would be nice, but isn't it supposed to be 720 kilobytes? If it is 720 megabytes, where do I sign up to get one?

Wally Young
Placentia, California

As soon as I hear of one, I'll let you know. For now, we'll all have to live with 720K-byte drives, and I'll have to try and live this one down.
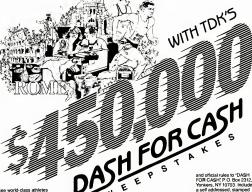
But when fact follows fiction, there's usually not much of a time lag—some disk makers are developing 3½-inch drives capable of storing 20 or 30 megabytes.

ASK THE ADVISOR

Send your questions to the PC Advisor, *PC Magazine,* One Park Avenue, New York, NY 10016. ⚏

PC MAGAZINE FIRST LOOKS

Borland Builds Speed, Power into Turbo Basic

BY ETHAN WINER

With the release of its eagerly anticipated Turbo Basic, Borland International has created the most powerful version of BASIC ever.

More than just another "me too" in the current proliferation of advanced BASICs, Turbo Basic offers some features which are truly revolutionary. Of course, line labels are supported, as well as multiline if-then-else clauses, procedures, and local variables. But Turbo Basic takes these now-standard features and then adds a number

Turbo Basic uses separate windows for program editing, output, and tracing execution. Function keys move you through the windows.

of additional capabilities.

To begin with, it supports the 8087/80287 numeric coprocessor, a wider range of array subscripts, and recursive procedures and functions. Not content to stop there, however, Borland has also added a terrific binary mode for file I/O, a case/select structure, long integers, and named constants.

Like Turbo Pascal, Turbo Basic provides a complete, self-contained environment in which program source files are created, edited, and tested.

Separate windows are used for editing, program output, tracing a program's execution, *(continues on page 34)*

EasyTax Turns 1-2-3 into A Federal Tax Preparer

BY LAURA LOU MEADOWS

For 1-2-3 lovers, the template's the thing. As the season of the Form 1040 is almost upon us, *EasyTax* is the template that transforms 1-2-3 into a screen that looks like Uncle Sam's most popular form.

Used with 1-2-3, *EasyTax* also does 18 other forms and schedules and has a 3-year tax planner. After you've done your return, the *EasyTax* Analyst

feature will compare the results of your tax calculations with government statistics of other taxpayers in your bracket and will let you know how your deductions stack up with the average. Then it tells you the percentage of returns in your bracket that get audited.

If you are already proficient with 1-2-3, you're probably to the point in which the learning thin, for the *EasyTax* template is minimal. After you've made a working copy of the template program and breezed through

the start-up instructions on the disk that summarizes the small instruction manual, you are ready to start filling in the Form 1040 right on-screen in the same way you would fill in the paper version that comes in the mail.

The *EasyTax* labels and formulas are worked out so that any item of information entered in one form can be integrated into all the other forms in which it is needed. You go from one form to another by typing F5 and the schedule or form letter *(continues on page 34)*

Turbo Basic

and other system functions. Matching Borland's lively interface standards, these windows may be turned on and off or zoomed in and out.

Fast Screen Writes

One of the first things you'll notice is Turbo Basic's ultrafast screen output. Turbo programs automatically adjust to the type of adapter that is installed in the host PC. Then, rather than call upon the BIOS to display text, special routines write directly to screen memory at the fastest possible speed.

Screen output isn't the only thing that's fast. Written entirely in assembly language, Turbo Basic compiles faster than anything I have seen. What's more, the programs it creates execute faster than those produced by other compilers.

Using Quick Sort on a random 5,000-element floating-point array, Turbo Basic took 2 seconds to create the array and 16 seconds to sort it. Microsoft Corp.'s QuickBASIC, Version 2.0, came in far behind at 6 and 135 seconds, respectively.

In another test, Turbo Basic compiled a 1,200-line program to disk in 24 seconds, as opposed to over 30 seconds (for QuickBASIC. And note that the .EXE files that Turbo Basic creates are true standalone programs. The .EXE programs can

Easy customization makes Turbo Basic a joy to use. Options are presented in pull-down menus. Even multiple configuration setups are possible.

ated by QuickBASIC require a separate library file to be loaded at run time.

Another benefit is the way large programs are accommodated. Since no separate link

step is required, extremely large source files may be compiled directly. The $Segment metacommand lets you mark 64K-byte (or less) sections of the source program, and a special spooling technique is used to continuously compile to disk.

More than two dozen additional commands and features have been added to the BASIC language. Some of my favorites are a B and B in5 for binary numbers and MTimer for timing events to a resolution of 2 microseconds.

Network support is not built into Turbo Basic; however, the language does let you access the processor's registers and then

call any of the DOS or BIOS interrupts. Thus, it is possible to lock and unlock file records, though not without some difficulty.

There are other shortcomings as well. Unlike QuickBASIC, the compiler will catch only one error at a time, and the program trace mode is not as nice as QuickBASIC's. But my biggest objection is the way the editor leaves .BAK files all over the place. In any program, automatic backups should be an option—period.

All in all, though, Turbo Basic is an outstanding compiler, and I wouldn't be surprised to see many frustrated C and Pascal users switching to it.

BASIC Moves into Adulthood

At the age of 23, BASIC may be ready to shed its sophomoric image and start walking tall as a serious programming language.

BASIC took a giant step into the starring role of the programming world when IBM, in essence, gave away a simple adaptation of it by burning it into the ROM of the original PC.

It quickly became the PC power user's favorite toy, great for trying out program ideas without messing with flowcharts or defining every last variable before starting.

BASIC may be tolerant, but it isn't fast. And, because it demands no discipline, it can be a nightmare to debug.

Many people who learned BASIC programming on a PC moved on to Borland's

Turbo Pascal, which is fast, encourages good programming practices, and provides ample debugging help.

Microsoft countered with QuickBASIC 2.0, a speedier compiler that gives plenty of help.

Now BASIC's creators, John Kemeny and Thomas Kurtz, have been working on their own improvements. TrueBASIC 2.0 adds speed and trace debugging (a review will appear in First Looks in our next issue).

Borland seems to have built the necessary speed and features into Turbo Basic to keep BASIC programmers from moving on to a new language. The question is, are these new arrivals too late? Or should we wait for Turbo C?

—*Gus Venditto*

EasyTax

or number. The Available Forms menu stays on display on two lines near the top of the screen. On the first pass at the 1040, it can be puzzling to see the "protected cell" message warning you that you can't fill in a particular blank. Then you realize that this is the program's way of making you do the supporting schedule first, so that it has a chance to get the details and do any necessary subsidiary calculations for you.

A reassuring feature of *Easy-Tax* is the odometer that rides at the top of the screen. It shows you your tax liability and the amount you owe or your refund as you go along. When you

want to see the bottom-line effect of any new entry, press F9 to update the calculations and see your new key figures.

I tried out *EasyTax* on my colleague, a computer maven who's used *1-2-3* for doing his tax returns for the past couple of years. He came back saying the program was fine, "but if I use this, I would miss all the fun of working out my own formulas." If you have a different idea of fun, *Easy-Tax* may be just the program that gets you through your tax return in time to salvage part of your weekend.

Actually, I thought it was fun to see the formulas in the upper-left-hand corner, just as they appear in any *1-2-3* spreadsheet. You might even learn a little more about how to write your

The Tax Advantage: Seasonal Relief

PC **HANDS ON**

BY CATHERINE D. MILLER

The Tax Advantage is for everyone who'd like to put distance between themselves and Uncle Sam's Form 1040, while simplifying the filing process.

In its fifth year, *The Tax Advantage*, Version 186.0, offers fewer forms than *EasyTax* or *TurboTax* (see First Looks, page 33, *PC Magazine*, Volume 6 Number 4, for our review). It supports five Federal tax forms (1040, 2106, 2441, 4562, and 6251) and eight schedules (A, B, C, D, E, G, SE, and W). But *The Tax Advantage* shields you from the overwhelming complexity and clutter of the government's forms.

Each form or schedule is displayed as a simplified version of the actual IRS form. Because on-line help is minimal, you'll need to refer to the IRS instruction booklet for guidance. *The Tax Advantage*'s quick demonstration program can get you through the nonintuitive command structure painlessly.

If you feel comfortable with Form 1040's structure, you may be put off by the way the program prefaces every entry with E for Enter, A for Add, I for Itemize; you can't just type in a

number on a line. But this structure works well in keeping tabs on your entries.

You can itemize any line on any form—beyond what the IRS requires. This is helpful if you want to keep track of different sources of income, for example. Lines on Form 1040 requiring itemization by the IRS are dynamically linked with the proper forms and schedules, which the program will remember to print when you're done (or think you are).

The Tax Advantage continually recalculates your tax liability as you enter new items;

you can display your tax and tax bracket at any time. By pressing O to invoke the Options command, you can find out what your tax will be if you change a line of any form or schedule.

If you want to compare taxes when several items are changed, the Tax Planning feature will calculate your new tax liability. However, you cannot display the results of two different tax scenarios at the same time. And, because the new tax laws for 1987 aren't taken into consideration, this feature isn't reliable for tax-planning purposes.

The Tax Advantage's uncluttered menu structure helps keep confusion to a minimum; a tax overview (bottom of the screen) can be called at any time.

Although it doesn't offer a multitude of forms, *The Tax Advantage* is a great help to those who are filing a simple tax return and don't want to do the calculations on their own.

It can also take some of the drudgery away from tax filing by sparing you from the IRS's intimidating language. *The Tax Advantage*'s sparse structure is a far more appealing way to face the April 15th deadline than dealing with Form 1040 all by yourself. ▫

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formulas if you pay close attention.

EasyTax does not have state tax-return modules this year, so you can satisfy any cravings you may have for spreadsheet formula-writing when you complete the state return.

Help With W-4 Form

In response to requests, the company added help in dealing with the IRS's latest curse on the taxpaying public: the four-page W-4 form. *EasyTax* helps in figuring out the proper allowances to claim and will give you an estimate of the income the IRS will withhold; a number the government doesn't provide.

EasyTax may be published by a small company, but it maintains a very healthy ap-

proach to customer support. Last year's registered users can upgrade for $25; this year's us-

ers, the company says, will be able to upgrade next year (to do 1987 tax year filing) for $30. ▫

The 1-2-3 formulas are right where they always are, in the upper-left-hand corner. You won't have to touch them, unless you use EasyTax for a state tax return.

Celebrity Packs Lots of Value Into $90 Word Processor

PC HANDS ON

Superb integrated features and choice of interfaces put *Celebrity* at the top of its class.

BY MITT JONES

Celebrity, Good Software Corp.'s new word processor, first piques your curiosity with a list price of about $90. Then it reels you about and nails you to the wall with a list of features few other word processors can claim.

You get most of the power features you'd expect from a $300 word processor—including an on-line tutorial, an 80,000-word spelling checker, a thesaurus, macros, windows, and mail-merge—but the features don't stop there.

You also get a first-class integrated calculator and an equally impressive calendar. Then there is the Forms feature, which is essentially a ready-

made, general-purpose database with mail-merge capability. Add to that a three-pronged command interface that allows you to invoke each command via *1-2-3*-like menus, a command line, or function keys, and

rectly display an underlined word within a group of words already in bold display, though the text printed as it should have.

In addition, *Celebrity* simply lacks the sophistication of top-

Celebrity's interactive spelling checker suggests alternate spellings and even flags sentences that don't begin with a capital letter.

you've got what would seem to be the perfect word processor for personal use. But, while many of *Celebrity's* features are so powerful and well implemented that you'll be shouting with delight, the program is not without its faults and limitations.

The program could not cor-

of-the-line professional word processors in some areas—though they are few. For example, *Celebrity* does not support print spooling, does not offer automatic outlining and footnoting, canno,_ .serve case during search and replace operations, and has limited header and footer capabilities. These limitations, though not at all unusual in personal and professional word processors, restrict *Celebrity's* usefulness in a corporate environment.

Three Ways to Format

Celebrity occupies the bottom three lines of the display screen with three information lines—the status line, command line, and message line. The status line displays information such as the current document and the position of the cursor. Ctrl-Alt moves you to the command line, where you can enter any one of about 100 English-like commands.

Alternatively, you can issue commands through a point-and-shoot menu. You hit the PrtSc key to display the primary menu

on the command line. The message line, directly below the command line, displays the menu options that you can access through the highlighted command line option.

When not being used for menu display, the message line gives you helpful tips and reminders.

Celebrity's third user interface puts your PC's Ctrl, Alt, and function keys to good use. You can issue most commands, including a wealth of block commands, with one keystroke combination, though a keyboard template is conspicuously missing.

Celebrity's formatting scheme utilizes formatting lines within the document, instead of hidden control codes, to keep track of format changes. Horizontal rulers display the current horizontal margin and tab settings, and vertical rulers display vertical margin and spacing information. You can modify formats by creating, editing, copying, moving, or deleting both types of rulers.

All in all, *Celebrity* is a powerful, flexible program that is likely to make waves in the future. Though Version 1.0 lacks the sophistication it needs in some areas to qualify as a top-notch professional word processor, *Celebrity* has the potential to blow most personal word processors—and a good share of professional word processors—off the shelves.

Unexpected Features Add Power To a Low-Cost Word Processor

Celebrity's integrated calculator, calendar, and database-like facility make the package a good choice for those who need only intermediate word-processing power and want one piece of software on their PCs all day—or perhaps a good choice for a home work-extending machine.

The calculator boasts business, scientific, and programming functions, as well as memory storage. The current document remains visible on the left side of the

screen, and the message line displays a running account of your equations. The calculator also lets you upload figures into the document. The calendar is easy to use and look at. You can print daily, weekly, or monthly schedules and print yearly calendars, as well.

The database-like Forms feature is ideal for keeping track of phone numbers and addresses and lets you print lists or perform mail-merge-type operations.

—*Mitt Jones*

Hotline: Phone as a Power Tool

BY JONATHAN MATZKIN

This *Hotline* won't connect you to the Kremlin, but it can do some amazing things with your modem and telephone.

General Information packed its $39.95 memory-resident program with four phone directories, an auto-dialer, and a call log and then wrapped the package in an inviting, simple-to-learn user interface.

Hotline's 2,000-entry national phone directory lists airlines, hotels, car-rental agencies, large corporations, and other utile numbers. Almost all major microcomputer suppliers are included. You can point-and-shoot your number or have the program search and then dial.

Hotline's cities directory posts the local time and area code for more than 3,000 cities.

A "hot key" pops up *Hot*line's main menu bar, which sits on top of seven logically organized pull-down menus. Alt-key combinations execute many major functions and are easily customized, so possible keycombination conflicts can be avoided (but the program won't run under *TopView* or *Microsoft Windows*).

A private directory is compiled from a text file, and unfortunately, must be recompiled whenever listings are added.

An area-code directory returns the location and local time for an entered area code. It also displays a list of all area codes in a specified state.

A log function will store the telephone number and city called, as well as the times and

Hotline's national directory can dial any of 2,000 corporate phone numbers; you can scroll through or make a request.

dates of each of your phone calls.

Hotline's beautifully realized combination of functions, and its low price, make it an outstanding product. And the next time your printer screws up, be ing able to dial customer support in a matter of moments could save enough time and hassle to recoup your *Hotline* investment.

Dac-Easy Base Lives Up to Its Name, Sets New Low-Cost DBMS Standard

BY JOE BENDERAVAGE

Here is a program that small businesses, unfamiliar with sophisticated database languages, will find useful for phone number lists, mailers, and supplier lists. More-sophisticated users will appreciate its integrity with other data file formats (including *dBASE II*, ASCII, SDF, or ASCII delimited files).

Everyone will be pleasantly shocked by its $49.95 price.

Dac-Easy Base is similar to *dBASE II* in appearance, yet it improves upon it in ease of use, system limits, on-line and contextual help, numeric accuracy to 15 digits, security by password, storage of more and larger memory variables, and on-screen report layouts. The program can interface with *dBASE II* files and emulate its

dot prompt, though *Dac-Easy's* menus are the better matrix.

Dac-Easy doesn't support a good number of *dBASE II's* less commonly used—but nonetheless powerful—features, including the Call, Copy Structure Extended, Create from Extended, and Modify commands.

Unlike *dBASE II*, only one command is needed to change the structure of existing databases already containing records. You can use three working areas, determine the relationships among records and files, do operations on subsets of records or fields, and join sorted or indexed files to produce a new table. Join and Append operations can be done through the Whole menu.

Files are displayed in rows and columns, and the displays can be customized. Each screen has a handy explanation line at

the bottom that changes whenever the cursor position shifts. Much mileage is derived from these few screens, prosaically used with the majority of commands.

A serious impropriety occurs within the Scope screen: two of its four choices (the Next and Record N options) work so poorly that when either choice is entered, the system is brought to a fatal halt. You'll lose any data entered but not already saved to disk when this happens. Because the Scope screen module is invoked for the Display, Locate, Delete, Count, and Copy commands, as well as five others, you need to use the Scope screen module often, but you ought to avoid the Next and Record N options completely.

Screens should be more definitive, with the results of a previous screen carried to the next. And several inconsisten-

cies between the manual and the program must be corrected.

Generally, *Dac-Easy's* command language is more English-like than *dBASE II*. In fact, the entire package is eminently user friendly.

Dac-Easy Base is very well suited to people who want an easy-to-use file manager.

a Multisync* or equivalent.) The VEGA Deluxe is also compatible with every other video standard: EGA, CGA, Hercules and MDA. And when used with a compatible monitor, it automatically selects which mode is right for your software's needs.

At Video Seven, we've sold over 200,000 EGA cards to people who've seen the difference. If you'd like to see the difference for yourself, just call 1-800-238-0101 for the name of the Video Seven dealer nearest you. (In California, call 1-800-962-5700.)
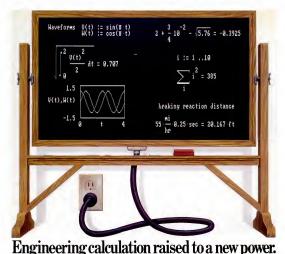
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Sharp Packs the Elements of Success into Portable PC-7100

PC HANDS ON

BY GUS VENDITTO

Sharp Electronics Corp. may be better known for its leadership role in the blanketing of the American outdoors with boom boxes than with being on the cutting edge of personal computer technology. Enhancements to Sharp's portable line, however, give the company every hope of bolstering its reputation as an innovative, reliable PC maker.

None of

The handle shifts between two positions, making the 20.6-lb. PC easier to carry.

the features in the Sharp PC-7100 are new, but the combination of a 20-megabyte hard disk, a 5¼-inch floppy disk drive, a backlit supertwist, supersharp blue LCD display in a 20.6-pound package makes this

a very attractive buy at $2,795. In many ways, it's an ideal home computer.

Virtually every inch of the PC-7100's squat box is packed. At 16.1 inches wide, 8.5 inches high, and 6.3 inches deep, there's little room to spare—just enough to add an internal 300/1,200-bit-per-second Hayes-compatible modem, an 8087 coprocessor, and extra RAM up to 704K bytes (in 128K-byte increments). The 84-key detachable keyboard has a separate numeric pad and is large enough even for my chubby hands.

Oddly, though the internal clock keeps time, DOS can't read it. Sharp didn't add the necessary interface to its version of MS-DOS 3.1. The time and date are accessed by hitting the ROM-based Setup menu.

Processing speed is not at the level of the Compaq Portable II (which will run you about $2,000 more), but the Sharp's 80C86-2 processor, clocked by PC Labs benchmark tests at 57.7 milliseconds), turned in a good performance. It even passed muster on *Microsoft Windows*—no mean feat for a portable.

The supertwist screen is easy on the eyes, even on CGA graphics; it is the same technology that is used in Zenith's Z-181 laptop. The Sharp screen measures in an objective, side-by-side eyeballing as just one notch less bright and less sharp than the Z-181.

The Setup menu allows a choice of a monochrome display adapter or CGA display. A wide-screen size results in an aspect ratio of 2.3 (versus 1.3 on a 13-inch CGA display), but

because the dot meshing is so good I'd take the Sharp's electric-blue display over a full-size CGA monitor for extended work.

All this makes the PC-7100 nearly ideal for home use except for one (maybe not so) minor detail. It may not run your favorite games; *Night Ranger* wouldn't boot.

It runs only on AC power, so it won't keep you busy on the morning train ride but, in all other respects, the PC-7100 mixes the right elements of portability and desktop power.

Benchmark Tests: Sharp PC-7100 vs. Compaq Portable II

PC MAGAZINE

Sharp's 20-Mbyte hard disk is fast—29 percent faster than Compaq's. But the Compaq Portable II—which equals an 8-MHz IBM PC AT in processing speed—beat the Sharp PC-7100 on the other processing tests by substantial margins (all tests were conducted at the PC-7100's top speed).

Performance Times
(Times given in seconds except where noted)

Product	NOP	8086 Instruction Mix	DOS Disk Access (Milliseconds)
Sharp PC-7100	5.70	27.70	57.70
Compaq Portable II	4.18	9.07	81.06

Relative Times
(Ratio Scales
PC-7100 = 100)

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 8086 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is set at the driver's default setting. The test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

Add-on 3½-Inch Drive Works with Variety of PCs and DOS Versions

Manzana Microsystems has introduced an external 3½-inch microfloppy disk drive that interfaces with a broad range of compatibles and DOS 2.0 or later. The compact unit is available in two versions.

The $355 MDQA connects to the external disk drive port on the IBM floppy disk controller card, much like other external microfloppy disk drives already available. The unit gets its power through the 37-pin port, eliminating the need for an additional power cord.

The $355 MDQX comes with an expansion-slot interface card that allows use of the disk drive with computers that lack an external disk drive port. The interface card also supplies power to the unit.

Manzana sells both the MDQA and MDQX disk drives with device drivers and a format program that allows microfloppy disks to be formatted for a full 720K bytes with DOS 2.0 or later. Other external microfloppy disk drives on the market require DOS 3.2.

List Price: MDQA, $355; MDQX, $395. **Requires:** MDQA: disk drive controller card with external disk drive port, DOS 2.0 or later. MDQX: DOS 2.0 or later. Manzana Microsystems Inc., 7334 Hollister Ave., Suite B, Goleta, CA 93117; (805) 968-1387.

CIRCLE 440 ON READER SERVICE CARD

Memory Expansion From IBM Supports 6 Mbytes on One Card

IBM Corp. has introduced a Memory Expansion Adapter for its 80286-based machines, including the 3270 AT. The board costs $749 with 512K bytes of RAM, and additional 1-megabyte memory modules are $349. Because the memory modules are densely packed, IBM says, a full 6 megabytes of memory can be installed on the expansion adapter without the use of "piggyback," or add-on, adapters.

Up to 6 megabytes of RAM can be packed onto IBM's new Memory Expansion Adapter ($749 with 512K RAM) for IBM 80286 computers. Add-on memory costs $349 in increments of 1 megabyte.

List Price: Memory Expansion Adapter with 512K RAM, $749; additional 1-Mbyte modules, $349. IBM Corp., 1000 NW 51st St.,

Boca Raton, FL 33432; (800) 447-4700.

CIRCLE 441 ON READER SERVICE CARD

Commodore Launches PC-Compatible Effort with Two Inexpensive Models

Add Commodore Business Machines to that ever-growing list of vendors vying for a hunk of the DOS computer pie. Based more for its home-market efforts and for the splashy Amiga, Commodore now offers two MS-DOS computers, the $999 PC10-1 and the $1,199 PC10-2.

Both systems are built around the Intel 8088 processor running at 4.77 MHz. Standard equipment includes the ATI Graphics Solutions display adapter card, which supports CGA, monochrome display adapter, Hercules, and Plantronics video modes. Also standard are RS-232 serial and Centronics parallel ports and five full-length expansion slots. The systems share a PC-XT–compatible BIOS and an XT-style keyboard with ten function keys and a numeric keypad. Commodore left

Commodore's PC10-2 features two 360K-byte disk drives and 640K RAM on the motherboard. The $1,199 machine has a CGA- and Hercules-compatible video card as standard equipment.

room inside both chassis for a full- or half-height hard disk.

The PC10-1 comes with one 360K-byte disk drive and 512K bytes of RAM on the motherboard (which is expandable to 640K). The PC10-2 has 640K on the motherboard and a second 360K disk drive. Commodore bundles MS-DOS and GW-BASIC with both computers.

List Price: Commodore PC10-1, $999, with 512K RAM, one 360K disk drive, ATI Graphic Solutions display card, and serial and parallel ports. PC10-2, $1,199 with 640K RAM and two 360K disk drives. Commodore Business Machines Inc., 1200 Wilson Dr., West Chester, PA 19380; (215) 431-9100.

CIRCLE 429 ON READER SERVICE CARD

Smooth Talk: A Surge Protector for Modems, Phones, Fax Machines

The Diamond Chip, a $19.95 phone-line surge protector from Curtis Manufacturing Co., safeguards telecommunications equipment. It also protects data during transmission through unprotected phone lines.

The device plugs directly into an AC wall outlet and accommodates two modular phone cables to close one complete circuit. A 360-degree swivel mount eases installation with equipment such as facsimile machines, telex machines, and modems.

Curtis Manufacturing's Diamond Chip is a $19.95 phone-line surge suppressor that safeguards phones, modems, fax machines, and other telecommunications equipment.

List Price: Diamond Chip, $19.95, with 6-foot patchcord. Curtis Manufacturing Co. Inc., 305 Union St., Peterborough, NH 03458; (603) 924-3823.

CIRCLE 443 ON READER SERVICE CARD

Third-Party Developers Debut Applications for Lotus PC Environment

Lotus Developer Tools has touched off a small avalanche of add-in applications for Lotus Development Corp.'s 1-2-3 and Symphony, fostering the rise of Lotus's architecture as a major PC operating environment.

The $150 Developer Tools allows independent software developers to attach add-ins directly to the 1-2-3 and Symphony drivers. Add-ins created with the tools run underneath 1-2-3

Panasonic Add-on Fax Board Runs in Background, Costs Less Than $1,000

Panasonic's $995 fax-simile board runs in the background and keeps track of all fax activity.

In the inexorable march of office-machine evolution, high-end and facsimile machines may soon go the way of the dinosaur. Their functions are being usurped by that marvelously adaptive creature, the PC. Panasonic Industrial Co.'s $995 FX-BM88 is the latest PC board that provides full fax functionality without dedicating its host system.

The full-length add-in card automatically receives documents or transmits them to multiple locations, even if you are running an unrelated application.

You can view and edit documents on-screen, using Panasonic's version of *Paintbrush*, which is bundled with the FX-BM88. The board's menu-driven software records and displays all facsimile activities. In addition, you can create a telephone directory.

List Price: Panasonic FX-BM88, $995. Requires: 256K RAM. Panasonic Industrial Co. One Panasonic Way, Secaucus, NJ 07094; (201) 348-7000.

CIRCLE 431 ON READER SERVICE CARD

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or *Symphony* and share Lotus's interface and menu structures.

Turner Hall Publishing's *4Word* (see First Looks, page 44, Volume 6 Number 4) is a full-featured word processor, as is *Write-In* from Blossom Software Corp. Blossom's $99.95 program has a full range of standard word-processing features, plus keystroke macros and mail-merge. *Write-In* supports the Lotus/Intel/Microsoft expanded memory specification. InWord, a $99.95 full-function word processor, is from Funk Software.

Amazon Systems takes a different approach for its $49.95 add-in word processor, *Plusworks*. The program provides basic, functional word processing, without bells and whistles. Amazon emphasizes ease of use as a selling point.

Datasheet, a $149.95 relational database add-in, expands the database power of *1-2-3*, according to Informix Software. The program stores data in a true database, rather than in a spreadsheet, but you can view data through the familiar *1-2-3* interface. You can build sophisticated database applications

that have data entry forms and complex reports.

SeeMore, from Personales Corp., displays *1-2-3* worksheets in new, revealing formats. The $99.95 program can shrink on-screen characters so that up to five times the usual number of cells can be seen at one time.

Goal Solutions, $79.95 from Enfin Software Corp., allows *1-2-3* to specify—and solve for—goals. *Goal Solutions* eliminates trial-and-error what-if guessing by calculating the desired value automatically.

A $50 financial projection add-in, *Kelpro*, is available from KEL Systems. The program calculates terminal rate of return, financial management rate of return, internal rate of return, and net present value. A report-generating function shows the present value of each cash flow line.

List Price: Lotus Developer Tools, $150. Requires: *Symphony* or *1-2-3*, Release 2.01 or 2.0; 8086-8088 macro assembler; 8086-8088 linker; DOS 2.0 or later. Not copy protected. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (800) 345-1043, (617) 577-8500.

CIRCLE 432 ON READER SERVICE CARD

List Price: *Write-In*, $99.95. Requires: 60K RAM; *1-2-3*, Release 2.0 or 2.01. Not copy protected. Blossom Software Corp., One Kendall Sq., #220, Cambridge, MA 02139; (617) 577-8879.

CIRCLE 433 ON READER SERVICE CARD

List Price: *InWord*, $99.95. Requires: 70K RAM; *1-2-3*, Release 2.0 or 2.01. Not copy protected. Funk Software Inc., 222 Third St., Cambridge, MA 02142; (617) 497-6339.

CIRCLE 434 ON READER SERVICE CARD

List Price: *PlusWords*, $49.95. Requires: *1-2-3*, Release 2.0 or 2.01. Not copy protected. Amazon Systems Inc., 28 Atlantic Ave., Beverly, MA 01915; (617) 927-8496.

CIRCLE 435 ON READER SERVICE CARD

List Price: *Datasheet*, $149.95. Requires: 640K RAM; *1-2-3*,

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Financial Analysis and Reporting Package Is Aimed at Fortune 1000

Fastar, $25,000 from Corporate Class Software, is not for mom-and-pop businesses. But for large corporations, the package provides a powerful, complete system for financial reporting and analysis.

Among some of its more important functions, *Fastar* collects, organizes, and manages financial schedules for multiple divisions or departments, accounting periods, and actual

Fastar makes heavy use of windows in its easy-to-follow user interface. The $25,000 financial analysis and reporting package is intended for large corporations.

budget or forecast categories.

Data can be loaded from popular micro-based packages such as *1-2-3* and *dBASE*.

List Price: *Fastar*, $25,000 for a departmental system that supports up to 25 users; trial implementation with real data, $5,000; data collection and setup services, $15,000. Requires: 640K RAM, hard disk, DOS 3.1 or later. Not copy protected. Corporate Class Software Inc., 1211 Ave. of the Americas, 23rd Floor, New York, NY 10136; (212) 719-8209.

CIRCLE 442 ON READER SERVICE CARD

Release 2.0 or 2.01; hard disk. Not copy protected. Informix Software Inc., 4100 Bohannon Dr., Menlo Park, CA 94125; (415) 322-4100.

CIRCLE 436 ON READER SERVICE CARD

List Price: *SeeMore*, $99.95. Requires: *1-2-3*, Release 2.0 or 2.01; EGA, CGA, or Hercules-compatible adapter. Not copy protected. Personales Corp., 2352 Main St., Bldg. 2, Concord, MA 01742; (617) 897-1575.

CIRCLE 437 ON READER SERVICE CARD

List Price: *Goal Solutions*, $79.95. Requires: 64K RAM; *1-2-3*. Not copy protected. Enfin Software Corp., 6920 Miramar Rd., #106A, San Diego, CA 92121; (800) 922-4372.

CIRCLE 438 ON READER SERVICE CARD

List Price: *Kelpro*, $50. Requires: *1-2-3*, Release 2.0 or 2.01. Not copy protected. KEL Systems Inc., 8 Taft Ave., Bethpage, NY 11714; (718) 229-7681.

CIRCLE 439 ON READER SERVICE CARD

Clipper Adds Support for EMS, DOS 3.1—Compatible Networks

F A C T   F I L E

HANDS ON

BY GLENN HART

The *dBASE* compiler and clone market continues to bloom even more competitive. Hot on the heels of *FoxBASE Plus* and *Quicksilver*, Nantucket has released its latest version of *Clipper*.

The Autumn '86 release is an evolutionary upgrade, *not a* new product. There are about two dozen new or enhanced commands and functions, several of which look useful but none of which are particularly earthshaking. *Clipper* can now access Lotus/Intel/Microsoft expanded memory for buffers, which should speed certain operations. *Clipper* still uses its own index files (boo!), but Nantucket has finally removed copy protection (hooray!).

The big news for serious ap-

plications developers is the addition of multiuser, networking support. *Clipper* applications can now run on networks that support DOS 3.1 calling conventions. Compiled applications don't require any run-time modules, and there aren't any licensing fees or royalties, no matter how many network nodes use the programs. This is

a far better scheme than Ashton-Tate's costly and cumbersome network access system. The networking commands themselves support record and file locking and are similar to those in *dBASE III Plus*.

The new *Clipper* clocked in at speeds 7 to 16 percent faster than the previous version. Improved memory-management

dBASE-Compatible Compiler Speed Test

(Times given in minutes and seconds)	Report 1	Report 2
FoxBASE Plus	0:26	1:01
Clipper, Autumn '86 release	0:42	1:28
Clipper, Winter '85 release	0:46	1:46
QuickSilver	0:46	1:56
dBASE III Plus	1:25	3:34

Timing the same two reports that were generated under *dBASE III Plus* and compiled under *FoxBASE Plus*, *Quicksilver*, and both releases of *Clipper* shows that *FoxBASE Plus* is still the fastest. Speed is not the only consideration for selecting a compiler, of course—compatibility with *dBASE* applications and ease of use are just as important.

techniques (even without expanded memory, which is how we tested them) and a better indexing algorithm are responsible for the speed improvements. Don't be surprised to see faster sorting in the next release.

The Autumn '86 *Clipper* is a definite improvement over prior versions on several scores. If you have been waiting for a networking, multiuser version of *Clipper*, your ship has just come in!

MatchPoint-PC Reads, Writes, To CP/M and Apple II Disks

F A C T   F I L E

HANDS ON

BY HOWARD MARKS

The largest computer-related investment any of us have isn't hardware or software but data. This investment of time and knowledge has stopped many people from converting from their present computer to a new system that is better suited to their needs.

Micro Solutions has solutions for anyone using Apple II or CP/M microcomputers.

Their earlier program, *Uni-Form-PC*, is a device driver that allows your PC to read and write over 100 different CP/M disk formats, including all the more popular soft-sectored formats (such as the Altos Series 5; DEC Rainbow; Epson QX-10; HP-125; Kaypro II, 4, and 10; Os-

borne 1; TRS-80; and Wang-writer).

With *UniForm-PC* running, your PC reads and writes CP/M disks just like they were DOS disks. (See "Beating the DOS-CP/M Compatibility Blues," *PC Magazine*, Volume 4 Number 7, for a detailed review of *UniForm-PC*.)

CP/M Emulator

Now, Micro Solutions can rescue the CP/M programs that you weren't ready to consign to the ash heap of history. *UniDOS* is a CP/M emulator that will run most CP/M software (including Z-80 code) in an ordinary 5¼-inch PC disk drive. The company sells a $195 half-card with a Z-80 for faster execution, but my tests found the program to be adequate.)

Apple II and North Star data

files can be salvaged with MatchPoint-PC, a card that installs between your floppy controller and drives. MatchPoint-PC includes *UniForm-PC* and lets you read or write data files from Apple II or IIe disks formatted under AppleDOS, Pro-DOS, SOS, or Apple CP/M.

All three products live up to their advance billing. I was even able to use all three at once by running the CP/M version of *WordStar* on an Apple CP/M disk. These products are the easiest way to exchange data between Apple IIs, CP/M machines, and PCs. They are strongly recommended if you are upgrading from one of these older systems, have to send or receive data from someone with these machines, or work in an organization that uses PCs and Apple IIs or CP/M machines.

Chessmaster: Challenge the Champ

PC HANDS ON

BY MITT JONES

The Chessmaster 2000 from The Software Toolworks will dazzle you with its animation, impress you with its features, and beat you at chess, provided you don't get frustrated and de-magnetize it first.

Chessmaster, which won the 1986 U.S. Open Computer Chess Championship in the PC class, offers 12 levels of play. Level 1 allows your wily opponent only 5 minutes to make 60 moves, and at that rate you should fare well.

But *Chessmaster* gets tough by level 6, which allows it 120 minutes to make 40 moves. You may never have the nerve to try level 12 (1 move per 6,000 minutes).

The Chessmaster 2000 gives you the option of a 2-D or 3-D display. You can play with the master or a friend; if you want, Chessmaster will referee the game.

You specify your move with the cursor keys or by entering the appropriate algebraic notation.

Chessmaster's board and pieces are both acceptable on a text display, but the fun starts with monochrome graphics,

which allows you to display the board in a crystal-clear 2-D image. A somewhat-less-sharp 3-D display is optional with color graphics.

Chessmaster is also packed with features that can help you improve your game. You can replay 100 classic chess games from the disk. You can also ask the game for hints or prompt it to analyze your moves.

If you like chess, buy *Chessmaster*. You are unlikely to find a more patient and skillful partner anywhere.

List Price: *The Chessmaster 2000*, $39.95; backup disk, $5; hard disk installation option, $10 with proof of purchase.

Requires: 256K RAM, one disk drive, DOS 2.0 or later. Copy protected. The Software Toolworks, One Toolworks Plaza, 13557 Ventura Blvd., Sherman Oaks, CA 91423; (818) 907-6789.

CIRCLE 448 ON READER SERVICE CARD

Forms On-File: Over 100 Templates

PC HANDS ON

BY MITT JONES

Brush your straight edge and pencil aside: Channelmark Corp.'s *Forms On-File* puts 100 ready-to-print business forms at your fingertips and makes designing new forms a breeze.

Ready-to-print forms are grouped by purpose in libraries, ranging from Accounting to Shipping-and-Receiving.

After you activate a form, the program returns to the main menu, where options allow you to edit and print the form.

The printed forms are crisp and attractive, and an optional company heading, which you specify once as the default, adds a professional touch to company forms.

Forms On-File supplies nearly 200 form templates that you can edit to suit your needs. You edit templates in the same way you edit ready-to-print forms.

An intuitive user interface makes it easy to copy, delete, or

edit new form libraries.

Forms On-File supports only dot matrix printers, and you can't view or edit forms as they will appear when printed.

Still, *Forms On-File* packs most of the forms you could ever need into a $59.95 pack-

age, and the program's simple structure and context-sensitive help are a real plus.

List Price: *Forms On-File*, $59.95; backup disk. $5.

Requires: 256K RAM. Copy protected.

Supports: IBM Graphics Printer or

Proprinter; Epson FX, JX, MX (with Grafrtax), RX, LQ-1500; Okidata 84, 92, 93, 182, 192, 193, 292; C. Itoh Prowriter; IDS 460, 560, Prism; NEC 8023; Toshiba P351; Dataproducts 8050. Channelmark Corp., Power Up!, 2929 Campus Dr., San Mateo, CA 94403; (800) 851-2917.

CIRCLE 449 ON READER SERVICE CARD

Learning DOS: A Lively Tutorial

PC HANDS ON

BY CATHERINE D. MILLER

From starting DOS to setting up a CONFIG.SYS file, Microsoft Corp.'s *Learning DOS* teaches DOS concepts and commands with a style that's friendly enough to put even the most frightened novice at ease.

You—or your computer-phobic friend—can move through the lessons at your own pace; Ctrl-key combinations allow you to skip around within a lesson. If you already have some computer experience, the program's self-test will direct

you to the lessons covering topics that are new to you.

Learning DOS includes lessons for hard disk systems and lessons for systems without a hard disk. The practice sessions interspersed throughout the lessons encourage you to try out the commands just covered. Troubleshooting sections following each lesson explain DOS's frustrating error messages.

The on-line DOS Quick Reference is extremely useful—even after the lessons are completed. Its extensive help screens can be summoned whenever there is a question

about a DOS concept or command. Furthermore, you can return to DOS and execute the command while help remains on-screen.

Microsoft's *Learning DOS* is a great way to learn how to harness the power of DOS. Power users may find that it is the perfect gift for every neophyte they meet.

List Price: *Learning DOS*, $49.95.

Requires: 256K RAM. DOS 2.0 or later. Not copy protected. Microsoft Corp., 16011 NE 36th Way, Redmond, WA 98073; (206) 882-8080.

CIRCLE 450 ON READER SERVICE CARD

Corporate Maneuver.

In the high-pressure corporate environment, every move counts. It's no wonder, then, that many corporate PC users are reaching for WordPerfect for powerful word processing.

Reaching the top.

WordPerfect is now the best-selling word processor for the IBM PC, according to market research firm InfoCorp. And customers like Ford, Chrysler and TRW are leading the way.

Meeting user needs.

But WordPerfect's climb to the top was no overnight success story. For the past three years, user feedback has been applied to each new version of WordPerfect, pushing it closer and closer to perfection.

The result is WordPerfect 4.2, a word processor with unsurpassed business features for the IBM PC and compatibles. Features like an elegant thesaurus, a 115,000-word spelling dictionary, document summary, columns displayed side-by-side on screen, windows, line drawing, statistical typing, and extensive printer support.

Make your move.

There is a word processor that is as productive for executives as it is for secretaries. WordPerfect 4.2. It's the consummate corporate maneuver. For more information, call or write WordPerfect Corp., 288 West Center St., Orem, Utah 84057, (801) 227-4000.

WordPerfect
CORPORATION

PCED 1.01a: A DOS Essential

HANDS ON

BY EDWARD MENDELSON

Every time you type a DOS command you use a text editor, but it's so primitive that you might never notice it. The DOS command editor doesn't do much. You can delete backwards and press either F3 or the right cursor key to retrieve your last command, but that's about all. All users have tolerated this because they didn't know they had an alternative. The alternative is *PCED*—the professional command editor. *PCED* is to the DOS command editor what *WordPerfect* is to EDLIN.

It's also a model of intelligent design. You don't need the manual to make the program do useful work. You simply run it. Because *PCED* isn't a clunky DOS shell, the command line looks the same as ever—but it is now responsive rather than recalcitrant. The cursor keys cy-

cle through your earlier commands, which you can modify or reuse, and the editing keys act the way you expect them to.

But that's just the beginning. Read the manual and you can use *PCED* to create macrolike "synonyms" for complex series of commands, complete with variables and parameters. *PCED*'s synonyms, unlike batch files, stay in memory, so they work instantly whenever you're in DOS, and they can be revised or replaced on the fly. If you want to save a set of synonyms for daily use, they can occupy a single ASCII configuration

In the middle of a command, you can press PCED's status key to see a list of user-defined command synonyms. You can then pick up where you stopped.

file that doesn't hog disk space.

PCED can memorize the parameters you use with a command or program, so that every time you enter "format" it will add "b:s". *PCED* synonyms can also include replaceable pa-

Spreadsheet Detective Keeps Tabs on Cells, Solves Errors

HANDS ON

BY JARED TAYLOR

Spreadsheet Detective from Deucalion Resources Group makes it easier than ever to debug a spreadsheet. Not only does it give you X-ray vision into the heart of your model, it wraps itself around *SuperCalc* or *1-2-3* and behaves like an organic part of it. You never have to switch between spreadsheet and analyzer because *Detective* is always there, ready to catch bugs and exterminate them on the spot.

When you run *Detective*, it loads first and then loads your spreadsheet. Then, whenever you need to use it, *Detective* springs into action when you hit Alt-F7. It takes up approximately 140K bytes of extra memory, unfortunately, and so you have

less room for model building.

When you don't need *Detective*, your spreadsheet behaves normally, except that it displays the "symbolic name" of the current cell. This is a clever invention that identifies each number cell by the contents of the nearest label cells, above and to the left. Thus, if the current cell is in the "1st Quarter" column and in the "Net Profit" row, the symbolic name of the cell is "1st Quarter, Net Profit," and it appears at the bottom of the screen. The actual labels may be nowhere in sight, so it's like having titles set in your spreadsheet all the time.

Once you call in *Detective*, it rounds up the usual suspects: circular errors, reversed ranges, empty unformatted cells, unreferenced constants, and other spreadsheet criminals. It cross-references a worksheet to show

which cells reference each other and maps it to show a bird's-eye view of the format. But *Detective* is at its best when it's probing formula logic. Other programs can show you what's in a cell, what's in the cells referenced in it, and so on. But *Detective* shows cell relationships three ways:

• As normal formulas: for example, the contents of E18 are E16/E4.

• As actual values: 10,000 is 120,000/12.

• As symbolic names: (1986, Average Sales) is (1986, Total Sales)/(1986, Number of Months).

Formulas make much more sense when you can see names and values.

Finally, you can change your model while you're in *Detective*: it doesn't allow you to forget the fix while you're switch-

ing back to the spreadsheet.

Spreadsheet Detective is slow at catching CIRC errors, and its manual is a little foggy, but if you can give up 140K bytes of RAM, it could pay for itself in half an hour of spreadsheet sleuthing.

Today's 386 compatibles fall into two categories:

Those that "enhance" technology.

And those that blow it away.

The PC Designs GV-386 is not an enhancement. It's the fastest 80386-based compatible you can buy.

That's because the engineers here at PC Designs realized early on that to take full advantage of the 80386 chip, an equally revolutionary motherboard was needed.

So they started with a blank piece of paper and—from the ground up—designed a 80386 micro that blows the doors of every other compatible available.

Get Power Hungry

At the heart of the GV-386 is a 32-bit processor operating at 16MHz clock speed; keyboard switchable to 8MHz (it will even support 24MHz operation, once Intel makes that available).

And that's Zero Wait State clock speed, thanks to a specially-designed, high-speed memory cache circuit. When enabled, this unique circuit—with a full 64K of static RAM—allows you virtually instant data retrieval 80 percent of the time.

The cache circuit—a PC Designs exclusive—also ensures rock-solid reliability because it eases the load high speed puts on the integrated circuits. Even at zero wait state, the GV-386 never exceeds IC design specifications.

Radical, but compatible

Despite its radical innovations, the GV-386 was designed to retain the standard 8MHz IBM PC-AT bus timing. The result is unparalleled compatibility with existing software and hardware.

And every GV-386 is bundled with Desqview 1.3 from Quarterdeck Office Systems, giving you both expanded memory management and multitasking capabilities allowing up to nine simultaneous operations.

Affordable power

If all this speed and performance doesn't blow you away, take a look at the price: The standard system starts at around $4000. And it's available now.

The fact is, it's the most innovative compatible to date. So why settle for an 80386 machine that just "advances" technology, when the GV-386 blows it away?

PC Designs

2500 N. Hemlock Circle
Broken Arrow, OK 74012

19 Rector St., Suite 2705
New York, NY 10006

Call us now in New York: 1-212-514-7280, in Tulsa 1-918-251-5550

■ COMMUNIQUÉS ■ EDITED BY BILL HOWARD

System 386

'Johnson attributes the speed difference to the 68020's efficient on-chip instruction cache and the full 16 MHz 80-bit 68881 math coprocessor (which speeds up processing of floating-point computations) vs. the slower 8.0 MHz 80287 coprocessor on the Deskpro 38.'
—Press release for Levco's Prodigy 4 Macintosh enhancement board.

Thanks, but We'll Wait for PageMaker

Savvy magazine described eight business opportunities for women who want to be their own bosses. Number one was desktop publishing. Also on the list: hazardous-waste removal and drug testing.

It Must Be Single-Sided

"Atari 1050 Disk Drive, features 127 bytes of data storage capacity. Now $139.97."
—Ad for Lionel Kiddie City, Baltimore Sun, December 22, 1986.

Elementary, My Dear Watson

"For installation, the computer keyboard is plugged into PC Type Right which, in turn, is plugged into the computer's keyboard.' "
—MIS Week, November 3, 1986

Hemingway Wept

"NEW YORK—In the Guggenheim Museum, an exhibition of sculptures created to stand all alone in forests and deserts, far from civilization, seemed at odds with Microsoft Corp.'s introduction, at the museum, of a word processing package designed to integrate Apple Computer's Macintosh into corporations and create a bridge, if tenuous, between the IBM personal computer environment."
—57-word lead sentence, MIS Week, November 3, 1986

Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to Communiqués, PC Magazine, One Park Avenue, New York, NY 10016, (212) 503-5293 or MCI Mail 157-9301.

Contributors receive $50 and a PC Magazine T-shirt. Contributors this issue: L. Mark Compter (IMMXT), Jim Seymour (Deskpro 38), Patricia Phelps (award-winning lead, keyboard), Maarten Calon (Atari drive).

PCED

rameters that stand for the current disk drive, path, date, time, and much else. This lets a one-letter synonym automatically tell a program like *Jet* or DOS's XCOPY to back up files that have today's date. You can even train a *PCED* synonym to record the date in the configuration file after doing a backup, so that you can use the same synonym later, and it will back up any files created since the last day you used it.

With *PCED* you can make a silk purse out of DOS's ear. Do you ever need to edit your system's path? Normally you have to retype it three times before you get it right. With *PCED* you can call up the existing path and edit it the same way you edit other commands. Or, you can assign synonyms to individual users and generate an automatic log of their computer activity.

The package includes programs that work with *PCED* to create resident commands that any self-respecting DOS would have included long ago. One command provides a customizable directory, another changes file attributes, one recalls text that scrolled off screen, another feeds keystrokes into applications, while yet another lets you invoke *SideKick* within *PCED* synonyms. Programmers can write more commands using the guidelines provided.

Since *PCED* does its work only in DOS, it won't gum up your applications. If you make "Venus" your *PCED* synonym for "dir \solarsys\morning.*", you can still type "Venus" in your word processor and get "Venus." There's one exception to this DOS-only rule. With certain programs, notably DEBUG and SYMDEB (the debugger that comes with Micro-

soft's *Macro Assembler*), *PCED* provides a separate set of "user synonyms" that can help programmers keep their sanity while they suffer through a night of repetitive tasks.

PCED is crashproof, doesn't care when it's loaded, and never gets in the way. At 16K bytes, in its smallest configuration, it's compact enough to use with a floppy disk. Everything it does can be modified, suspended, or suppressed. It does have one disadvantage. If you use someone else's PC after you've installed *PCED* on yours, you'll feel as if you're driving a gas-guzzling old wreck. ■

Illustration: Kevin Magaña

Power has never

■ PC UPDATE ■ PEGGY GAVAN

MicroPro International Corp. has added more than 125 enhancements to WordStar Professional, Version 4.0, in its first upgrade since Version 3.31 was released in April 1983. Some of the new features include an on-line 220,000-word thesaurus, 40 programmable function keys, full path support, LAN support, and a built-in 14-function calculator. MicroPro is also offering new legal, medical, and financial dictionaries for $25 each. Version 4.0 is priced at $495 for single-user systems and $595 for the LAN file-server version. LAN node versions are priced at $150. Registered users who purchased WordStar Professional, Version 3.31, between December 1, 1986, and March 31, 1987, will receive free upgrades; all other registered users can upgrade for $89, plus tax and $5 shipping. Corporate customers can purchase updates from their dealers at discounted prices. In addition, MicroPro is offering new purchasers of Version 4.0 a $100 cash rebate or the opportunity to receive more than $300 worth of add-on productivity software. MicroPro International Corp., San Rafael, Calif. (800) 227-5609.

* * *

IBM Corp. has reduced the prices on two models of the PC-XT and one model of the PC AT. The PC-XT Model 286—with 640K bytes of RAM, a 1.2-megabyte floppy disk drive, and a 20-megabyte hard disk drive—had its price tag slashed by $600 to $3,395; the price of the PC-XT Model 089—with 640K bytes of RAM, a 360K-byte floppy disk drive, and a 20-megabyte hard disk drive—dropped from $2,895 to $2,660. The PC AT Model 068, with 256K bytes of RAM and a 1.2-megabyte floppy disk drive, is now $3,395—a reduction of $600. All three models include the IBM Enhanced Personal Computer Keyboard. IBM Corp., Rye Brook, N.Y. (914) 934-4888.

* * *

Lotus Development Corp. has begun shipping Lotus Freelance Maps, a collection of map sets designed for use with the Lotus Freelance Plus graphics package. Freelance Maps consists of five separate sets: Continents and Countries, U.S. Counties, U.S. 3-Digit ZIP Codes, U.S. Major Cities and Metropolitan Statistical Areas, and the U.S. Complete Set (includes all the U.S. sets, plus U.S. Congressional Districts). The U.S. Complete Set retails for $395, and each separate set has a retail price of $145. Lotus Development Corp., Cambridge, Mass. (617) 577-8500.

* * *

Quadram has added the Microfazer VI to its line of Microfazer print buffers. The new model is equipped with six ports—six serial or four serial and two parallel—that allow up to five PCs to share a

The long-awaited WordStar Professional, Release 4.0, has more than 125 new features, including an on-line thesaurus and a built-in 14-function calculator.

printer or plotter. In addition, the Microfazer VI features graphics and nongraphics modes for handling text or 1-2-3 files. List prices for the Microfazer VI are $995 for the 256K-byte version, $1,195 for 512K bytes, and $1,495 for the 1-megabyte model. Quadram, Norcross, Ga. (404) 923-6666.

* * *

Epson America has introduced the FX-86e and FX-286e dot matrix printers, enhancing its FX-85 and FX-286 models. The new models offer additional font selections, including standard roman and sans serif near-letter-quality fonts supporting pica, elite, proportional, italic, and condensed modes. Both printers also have an enhanced type-style selection panel and automatic single-sheet folding. Manufacturer's list price for the FX-86e is $549, and the FX-286e lists for $799. Epson America, Torrance, Calif. (213) 534-4500.

* * *

AutoSHADE and AutoCAD AEC Mechanical, two new enhancement programs for AutoCAD, are now available from Autodesk. AutoShade, priced at $500, is a full-color shade-rendering package that turns AutoCAD drawings into solid images with color, perspective, surface shapes, and features. AutoCAD AEC Mechanical, also priced at $500, customizes AutoCAD for the needs of mechanical engineers who design building systems. Autodesk, Sausalito, Calif. (415) 331-0356.

* * *

US Robotics is offering qualified electronic bulletin board system operators a discount price of $495 on its new 9,600-bit-per-second

Courier HST modem, which is regularly priced at $995. In addition, the company is reducing the prices on all Courier 2400c, Courier 2400, and Microlink 2400 modems that are sold to BBS operators by $300. For

more information, contact US Robotics at (312) 982-5001 (voice) or (312) 982-5092 (data).

* * *

Ricoh Corp. is bundling a complimentary package of SoftKey Software Products' KeyPack with its LP 4080R laser printer. KeyPack, which regularly sells for $395, combines three separate applications for printer utility control, business graphics, and mailing-list generation. The LP 4080R is priced at $3,495. Ricoh Corp., West Caldwell, N.J., (201) 882-2000.

* * *

Broderbund Software has released the Graphics Library: Holiday Edition, a collection of graphics, fonts, and borders for use with its The Print Shop program. The Holiday Edition, which sells for $34.95, contains more than 100 design elements for 26 holidays. Broderbund Software, San Rafael, Calif. (415) 479-1170... Aldebaran Laboratories has dropped the price on Source Print, Version 2.02, to $75, a reduction of $22. This cut follows a recent cost reduction of Source Print from $139 to $97. Aldebaran Laboratories, Pleasant Hill, Calif. (415) 930-8966... Computer EdiType Systems has dropped the prices on its MagicSeries line of document production software for WordStar. MagicPrint is now $99, MagicBind is $149, and MagicLaser is $199—down from $195, $250, and $295, respectively. Computer EdiType Systems, New York, N.Y. (800) 251-2223... Windows for Data, Version 2.0, has several new features, including foreign-language compatibility, multiple-choice fields, and an internal debugging system that traces errors and reports memory corruption. Registered users should contact Vermont Creative Software at (802) 848-7738 for information on pricing and upgrading... Financial Aids I, previously available for use only with Symphony, is now available for 1-2-3, Release 2.0 and later. The templates sell for $39.95 and can be ordered from J-Rander, Cincinnati, Ohio; (513) 232-6702.

FOR $199⁹⁵ YOU CAN GET YOUR BUDGET DONE TWO WEEKS AGO.

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Javelin is the only software package that accelerates the budgeting process. It not only puts the data at your fingertips, but it gives you the power to organize data, reveal your logic and your assumptions, and then communicate your analysis quickly to others.

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It's a good feeling to know that as you're doing your budget, you won't get lost along the way. Javelin's exclusive audit trail traces your logic, and lets you share your assumptions with others.

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This product is so valuable that INFO-WORLD magazine named Javelin "The Software Product of the Year" and PC MAGAZINE gave us "The Technical Excellence Award."

One user, Kathryn Wilson of Raychem Corporation was so impressed she wrote: "It's amazing how much time you can save. I can set up models in minutes rather than hours or days with Javelin's innovative and powerful features... the difference in time spent building applications can be as much as 10 to 1 over traditional spreadsheets."

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■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

PLEASE SHARE THE SOFTWARE

Even as the cost of development skyrockets for big software houses, the shareware market is thriving. What makes it tick? Here are three shareware success stories.

Shareware is big news these days, and it seems to fly in the face of the conventional wisdom that you need a big development staff and a bigger marketing budget to make a product a success. Products created by individuals and sold outside normal distribution channels are gaining respect and making big money.

One of the distinguishing features of shareware is that you can generally download the programs from computer bulletin boards or pick up the disk at a user group meeting. You try the program, and if you like it and use it you pay the registration fee. Otherwise, there's no investment.

Let's take a look at three new shareware products to see how they fit this simple formula and how they stack up against their commercial competition.

ProComm is one of the more obvious successes in the communications software market. The comm market is especially interesting since it was started on the PC by the granddaddy of shareware programs, *PC-Talk*. *ProComm* tips its hat to its progenitor by retaining many of its keystrokes. But there the resemblance ends. It's a full-featured comm program, with more protocols than any program I've seen. At the same time, it's slick, with good installation, nice use of color, and "exploding" windows that zoom into view. A command language and macros make *ProComm* competitive with the best comm programs on the market.

The functionality is fantastic, and the price (registration fee) is a painless $25, $50 if you want the printed manual and access to a support hot line. Unbelievably, the authors offer quantity discounts as deep as 40 percent to corporate purchasers.

ProComm's creators, Tom Smith and Bruce Barkelew, are both amazed at their success and ready for more. While they intend to continue to support *ProComm*, they envision a commercial version with a higher price tag and even more features. Ironically, the individual users, the ones who were the biggest supporters of *ProComm* during its infancy on the bulletin boards, are the least conscientious about registration fees. Corporate users, on the other hand, have been diligent, despite the inherent problem of explaining to the purchasing department that they should pay $25 for something they already have.

ANOTHER WORD PROCESSOR?

Move over, *PC-Write*, here comes New York Word. *NYWord* is not for everybody. While it sports all the features you'd expect in a modern word processor, the user interface is unconventional. In a sense, it's a cross between *WordStar* and *EMACS*, one of the great minicomputer-based text editors. *NYWord*'s Spartan display uses only one line for status, leaving the other 24 for text. Its help messages are cryptic, and the Alt- and Ctrl-key combinations aren't always mnemonic.

But behind *NYWord*'s ruggedly individualistic user interface is its real power: many of the commands take arguments or are parameter driven. You can press Alt-J to justify a single line of text. Or you can press the Esc key, the 5 key, and Alt-J, and it will justify the next five lines. This is clearly a word processor for people who enjoy thinking about the processing of words. Devotees argue that it's considerably faster to issue such commands than to turn on text marking, move the cursor, issue a text processing command, and disable the text marking, as is common with most other word processors. They're right, but you have to want to be fully engaged with the process in order to be good at it.

In case you're beginning to suspect that *NYWord* is a programmer's text editor that got dressed up as a word processor, consider that it has headers and footers, footnotes, spelling checking, multicolumn printing, math calculations, widow and orphan control, and a heavy-duty merge facility. It also has the most powerful search-and-replace this side of *XyWrite*, and it has an index generator and can edit files in as many as 12 windows simultaneously.

Of course, the documentation needs to have a close encounter with someone other than the program's author, and the key as-

■ FROM THE EDITOR'S SCREEN

signments aren't what I would have chosen. But this is one powerful product, especially for its registration price of $35.

RamNet is perhaps the most ambitious of the current crop of shareware, a cross between an RS-232 network, electronic mail, and a bulletin board system. *RamNet* is a terminate-and-stay-resident program that communicates with other *RamNet*-equipped PCs, whether they're hooked up by wire running from one RS-232 port to the next or by knowing the phone numbers of modem-equipped PCs. Networks of PCs can communicate with other networks of PCs under *RamNet*, a slick combination of wide- and local-area networking.

RamNet is especially noteworthy for the degree to which it is thought out. It has password protection and security features aplenty, excellent documentation, and an abundance of attractive features, including comprehensive electronic mail, a bulletin board, communication with UNIX mail systems, and a powerful command language. It's not for local device sharing or simultaneous database access. It's for people who need to communicate from PC to PC. And it's a bargain at $149, less if you don't want support or a manual.

You'll probably want to know more about these products, so here are some phone numbers: *ProComm*: (314) 449-7012; *NYWord*: (212) 245-6510; *RamNet*: (212) 889-6431.

COMMERCIAL COMPETITION Do these and other shareware products compete with commercial counterparts? Yes, no, and maybe. The shareware market is a gentler clime than the retail/commercial market. It's a place where authors can try out new ideas, hone their programming skills, and discover the mix of features and performance that makes a good product—without losing their shirts or mortgaging their souls to venture capitalists. From that standpoint, it offers no competition to the commercial market.

But some products graduate from shareware to take their proper place among the good and great programs. The price invariably goes up, but the marketplace benefits from another worthy competitor.

And then something like *RamNet* comes along, a unique blend of features, testing the waters to see if there is a need for such a product. I predict there will be.

Now, how is it possible that a programmer or two, working in relative isolation, can best the giants at their own game?

Nothing, repeat, nothing, can stop you if you've got a good idea, the ability to actualize it, and belief in yourself. This is more than a pious platitude. If you don't have all three elements, you haven't got a product and you haven't got a chance. ⧉

---

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And all this power comes wrapped in an easy-to-use interface that PC Magazine called "elegant." PC World called QuickReport "a top-notch report generator that's easy to learn and operate."

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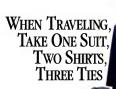
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CIRCLE 507 ON READER SERVICE CARD

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Referee manages RAM-resident program conflicts.

If you use desktop organizers, spell checkers, keyboard enhancers or other RAM-resident programs, you may have already discovered the horror of "RAM Cram."

RAM Cram occurs when memory-resident programs compete with each other (and with applications programs) for control of your keyboard or other computer resources. It's a fierce competition that can cause your computer to lock up completely. Then *you* pay the penalty—in lost time and lost data.

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Referee, by Persoft, is a new type of software that puts you in total control of your RAM-resident programs. And that puts Referee in a league all its own. You can create your own RAM Teams™ for specific applications programs. Team Superkey* and Sidekick* with Lotus 1-2-3*. Or call in Prokey* and bench the others when you switch to dBASE III*.

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Referee's Sideline™ menu enables you to control RAM-resident programs from within an applications program!

It's ideal for integrated packages like Symphony*. You can use a keyboard enhancer with the spreadsheet module. Or deactivate it, enter the word processing module and activate your favorite spell checker. It's easy. And you never have to back all the way out of the program!

Referee puts an end to RAM-resident program conflicts. At $69.95, it solves a very big problem for a very small price.

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■ JOHN C. DVORAK

THE KEY TO SOFTWARE SUCCESS

For the first time anywhere, the rules of the game that could make you rich. Forget about programming languages and customer relations—all you have to do is learn to count.

Everyone knows that every so often some guy comes along with a simplistic, but innovative, software idea and suddenly becomes filthy rich. We all think that someday the great software idea will come to us and make us rich, too. For many years I have tried to discover the key to success in software. I've finally done it.

The key to success is in knowing how to number your software releases. That's all there is to it.

Pay attention.

DVORAK'S INSIGHT INTO THE SOFTWARE JUNGLE: The earliest available versions of a product are called alpha-test, then beta-test, versions. The alpha-test version is usually seen by only the developers and a few close friends. This is because alpha versions *never* work. These releases are usually numbered .00 to .59 or so. How something can be called Version .59 baffles many observers. I've always thought it should mean that the product is 59 percent complete. When you get to Version 1.0, the product is 100 percent complete. Version 1.4 means that 40 percent of the code has been rewritten or improved. Version 2.0 means the product has been completely redone.

Traditionally, the first public release of a product is called Version or Release 1.0. Smart money always avoids Version 1.0 and waits until Version 1.01 or later is released, since Version 1.0 is notoriously bug ridden. Well, maybe that's how it should be for clarity's sake, but marketing considerations should prompt software sellers to take a new look at this release-numbering scheme. The goal is to make the buying public think that you know what you're doing.

DVORAK'S RULES OF SOFTWARE RELEASE NUMBERING: *Always use a decimal point in the number.* Never release a Version 1, 2, or 3. This does not appeal to the micro user's subconscious mind. You have to release 1.0, 2.0, or 3.0. It's even better to use two places and release products with release numbers such as 1.15, 2.35, and 3.20.

Start with Version 2.0. The key to success is understanding the psychological effect of the numbering scheme. The smart software vendor will start with Version 2.0. The heck with all the earlier numbers. This is a quick way to get recognition. Ashton-Tate knew this when it released *dBASE II*. There was never a *dBASE I*, was there? People will think you've used

starts to become a longer time when they see Version 2 of your product.

End with Version 3.0. Never release a product with a number higher than 3.0 to 3.4. If you have to release a Version 3.45 or some such nonsense, get ready to fold the company.

Simply put, Version 3 is the last version of any software package you'll ever need. If you happened to find a company that released Version 4 of a product, you'd discover that all that original creative types responsible for Versions 1 to 3 had long since flown the coop. Version 4 has to be a kludge.

Microsoft knows this. It never released Version 4.0 (in this country) of its MS-DOS for fear of overextending the product—giving people the impression that it was stale. If upgrades continued, you'd eventually have something like MS-DOS, Release 134.67. The product would be a laughingstock. "Can't they ever get it right?"

Therefore, Microsoft will promote A-DOS or CP-DOS 1.0 and start over again rather than release MS-DOS 5.0. Very smart thinking.

DVORAK'S SECRET TO A QUICK BUCK: Now it seems to me that if you had a hot software package and you wanted to make a quick buck with it, then you'd release it as Version 3.0 with a sticker on the box that boldly proclaimed it as "NEW! Version 3.0."

You'd rake in the easy money and retire early. That's all there is to it. Great business, huh?

■ JOHN C. DVORAK

INSIDE TRACK

Some say the new open-architecture Mac will leave the PC feeling claustrophobic. But what do they know?

Apple Slated to Become IBM Compatible This Year. Many of my friends say they can't talk to me. They're under nondisclosure, they mumble. It's **the hottest thing they've ever seen.** "Even *you'll* be impressed." Then they say, "It's from Apple." I am baffled. Then one day, as I am finishing a diatribe for a local paper, a bigshot editor calls me and tells me that *even I, Dvorak, the tormentor,* will buy the **new open Macintosh.** He tells me, "Sculley has said privately that after this machine appears, the compatibility problem will be IBM's problem." Harsh words—bravado or a bluff? Whatever the case, expect to see Apple products reviewed in the pages of *PC Magazine* by this time next year. **Apple has plopped an 80286 card running MS-DOS and a special version of *Windows* into its forthcoming Macintosh machines.** The hottest of the group—the Paris workstation—already has a screaming 16-MHz 68020 driving it.

Then again, I've been hearing this kind of *malarkey* for a year. It's possible that Apple can sell a few AT-compatible machines to the world of the PC, but its pricing strategies and image will prevent any real market penetration. This is despite the declarations of a few columnists who claim that the Mac is the "in" machine in the world of business. What have they been smoking? Apple is viewed by too many people as a toy computer or a yuppie computer. The Apple II, for example, is seen as a school kid's computer or a game machine. Let's face it: it's an old home computer. **And take the Mac (please!).** The Mac is, at best, the front-end to a desktop publishing system. Great for newsletters if you like little screens. It's also a yuppie computer and an easy-to-use computer for dopes.

Notice the word *business* doesn't appear here. (Oops—it just did!) Apple simply cannot get on the desks of the corporation in any numbers. So it decides to redesign the Mac and turn it into a combo Mac/80286-AT compatible (just as the 386-class machines gear up). What can we expect from this strategy? Well, not on the above list is an overlooked generality about Apple. **Apples are high-end machines.** The company does not sell bargains. Apple still sells its Apple II line for about $1,000 per machine, while an Apple II lookalike from Hong Kong, the Laser 128, can be had for $300 to $400. Also overlooked in the big picture (but not for long) is that businesses traditionally buy computers not because of features or software, **but on a cost-per-use basis** (millions of instructions per second) basis. Because of its high prices, Apple can't compete in the business mips market with the clones. Add to this roadblock the tendency at Apple to do a mediocre job on its software. The company still hasn't been able to design a reasonable file server for its AppleTalk network. We'll see what happens.

Politics Dept.: All hell has broken loose amongst the information providers. While the Commerce Department wants to turn the U.S.A. into the world's information provider, the Defense Department and the National Security Council want to stop the flow and availability of information from sources such as Lockheed's Dialog. Just before Admiral John "Irangate" Poindexter headed toward the shredding machine, he penciled a controversial memo that defined most **on-line information as "sensitive."** Maybe he should have logged onto CompuServe's CB to take a look at what's really going on.

Nifty Utility Dept.: Get a copy of *Hotshot* from Symsoft for $99.95. It allows you to shoot a snapshot of a screen and then manipulate it, draw on it, cut and paste it, and export it to a printer or to *PageMaker* or *Ventura Publisher* for insertion into a document. Quite fancy. Call them at (415) 962-9500 for more information.

This month's **Cute Product Award** goes to Microsoft for its special font cartridge (#92286Z) for the Hewlett-Packard Laserjet. For use with *Microsoft Word*, the cartridge contains **four different point sizes of both Times Roman and Helvetica** (actually Helv and Tms—clone fonts). It's the best all-purpose font I've ever seen for the HP Laserjet. The suggested retail price is a hefty $330. Ouch! Too high.

Joke Dept.: If you have the chance to get on some of the big-time national networks, such as USE-NET or UNi-Net, you should be able to find a group called **Net.Jokes** or some such thing. In there I found this IBM joke—the only one I found specific to IBM.

Three women are sitting in a bar discussing their lovers. The first says, "Mine's a wrestler. He's really forceful and aggressive in bed." The second says, "Mine's an artist. He's delicate and gentle." The third stares bleakly at her drink. "Mine sells IBM equipment," she says. *"He sits on the edge of the bed and tells me how good it will be when I finally get it."*

Tasteless? Poignant? Who knows? Don't you think we can do better? If you've heard an IBM joke send it to **John C. Dvorak's Inside Track Joke Contest,** *PC Magazine,* One Park Avenue, New York, NY 10016. I'll print the best ones and crown a winner. Send a self-addressed, stamped #10 envelope with a joke, hot tip, or interesting observation, and I'll send you a *PC Magazine*/Inside Track pocket protector. **A fantastic collector's item!** ▣

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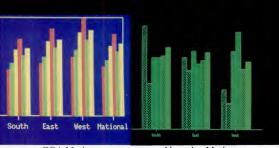
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EGA works with every popular PC video mode. And is smart enough to switch to the right mode every time you change programs. Automatically.

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Runs all EGA, CGA, MDA and Hercules Software with true hardware level compatibility.

True hardware compatibility makes the Paradise Auto-Switch EGA Card different from other EGA Cards. No other EGA Card offers the

■ PETER NORTON

EXPLORING FLOATING POINT

When numbers get messy, PCs deal with them by using floating-point arithmetic. Over the next few columns, Norton will be exploring the different ways that PCs handle this job.

Our PCs are basically designed to work with two kinds of numbers—plain old whole numbers (integers) that aren't too terribly big and messy numbers that get really big or small or that involve fractions. This messy form of numbers is called floating point, and I'll be talking about it over the next few columns. (I'll be covering some of the basics, but even if you know all about floating point, bear with me, because something interesting is coming up.)

Floating-point numbers are used by all the programming languages under a variety of names. In BASIC, floating-point numbers are called *single* and *double precision*. In Pascal they are called *real*, and in C they are called *float*. They are used in spreadsheets in an automatic, behind-the-scenes way (the spreadsheet programs use whatever number format, integer or floating point, suits the needs of the numbers at hand).

While the integer format can be used to hold a limited range of numbers in an exact way, the floating-point format is designed to represent a very wide range of numbers, not necessarily exactly.

TWO KEY PARTS In order to do this, floating-point numbers are built out of two key parts—the part that holds the digits (for argument's sake, let's say the digits are 12345678) and the part that indicates where the decimal point belongs (for example, it could belong between the 2 and the 3, which would make our number a little over 12; or it could belong two places to the left of the 1, which would make our

number roughly ¹/₁₀₀. This second part "floats" the decimal point wherever it's needed, including, as our example suggests, far off to one side or another.

By floating the point, the number could become very big or a very small fraction. How much it can float sets the dynamic range of the numbers.

The digits part of the number, on the other hand, sets how precisely numbers can be represented. In the example above, we have eight decimal digits of accuracy. In principle, a floating-point number is only an approximate representation, but if a value can be represented exactly in so many digits, then the floating-point number will happen to be exact.

Overall, the precision of a floating-point number is set by the number of digits represented (and the number base that's used—our familiar decimal base of 10 or the computer's favorite, the binary system, or base 2). For example, ½ would be

represented exactly as a floating-point number in either base 2 or 10, while ¹/₁₀ would be exact in base 10 but not in base 2, and ⅓ would be only approximate in either base.

As I've suggested, floating-point arithmetic can be done in a variety of formats. The characteristics of each format determine several key things: how wide the dynamic range is (at the big end and the small end), how many digits of precision are used, and which number base is used.

If we know the inner workings of a floating-point format, then we know the range, the precision, and the number base. But the really interesting part is that even if we don't know the format, we can probe around and figure some of it out.

Years ago, I saw a program that was designed to do this very thing. To let you play around with the idea, I've translated it into BASIC (Figure 1). The idea behind this program is that it gently probes the edges of precision to see where the boundaries are. By this method, the program is able to calculate what the number base is, how many digits of precision are used, and if the leftover amounts of calculations are rounded or truncated.

The one thing that this program won't show, though, is the dynamic range of numbers. To do that, we'd have to be able to let our numbers get too big (overflow) and too small (underflow) and still keep on calculating. Usually, though, a program isn't allowed to do that, so this program just attempts to do what can normally be done in any programming language.

For my example, running this program

■ PETER NORTON

in BASIC shows that BASIC uses a number base of 2, that single-precision numbers have 24 binary digits (double-precision, 56), and that rounding isn't done. If you work with Pascal, C, or any other language, you can easily adapt it to explore the floating-point format in that language. Of course, the program has to be turned on its head to fit into the spreadsheet scheme of things, but that's not a major obstacle. We can just set up a spreadsheet in which each loop in the BASIC program (for example, lines 140–160) is boiled down to its key calculation (line 150), which is iterated down a series of rows; for simplicity we can skip the logic tests (line 140) and just inspect the results manually.

The same ideas that underlie our BASIC program can be used to explore the number format used in spreadsheets. Of
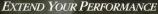
EXPLORING SPREADSHEETS To see how it works, I tried it out with spreadsheets from both 1-2-3 and Framework. The results were fascinating.

1-2-3 came out with a fairly normal result: the base is binary, the number of digits is 53, and, if I worked it out right, rounding is done. Since Lotus publishes the specifications for its data, we can

■ Floating-point format is designed to represent a wide range of numbers, not necessarily exactly.

check our results. According to the specification, numbers are stored in 52 bits of precision. At first glance our calculation of 53 looks like "close, but no cigar." But, looking more carefully, the problem disappears—because the format that 1-2-3 uses, like many binary floating-point formats, has an implied extra digit. So we're exactly right.

With Framework I got a different result: the number base came up as 10, showing that Framework does its arithmetic in decimal rather than in a form of binary. Calculating in decimal is intrinsically slower, which is why Framework isn't the champion of spreadsheet recalculation. But decimal can be more accurate in a practical (rather than theoretical) sense: in decimal-based floating point, decimal fractions are exact so that $.01 really is $.01 and not a close binary approximation. (Programmers long ago learned the trick of doing exact money calculations in binary floating point: avoid fractions by doing

■ PETER NORTON

```
100 ' A BASIC program to investigate floating point
110 '
120 DEFSNG A-Z ' Set to single (SNG) or double (DBL)
130 A = 2.0 : B = 2.0 : ONE = 1.0 : TWO = 2.0
140 IF ((A + ONE) - A) <> ONE THEN GOTO 170
150 A = TWO * A
160 GOTO 140
170 IF (A + B) <> A THEN GOTO 200
180 B = TWO * B
190 GOTO 170
200 AA = (A + B) - A
210 THE.BASE.% = AA
220 AA = THE.BASE.% - 1
230 IF (A + AA) - A THEN ROUNDING.% = 0 ELSE ROUNDING.% = 1
240 DIGITS.% = 0 : A = ONE : AA = THE.BASE.%
250 DIGITS.% = DIGITS.% + 1
260 A = A * AA
270 IF ((A + ONE) - A) = ONE THEN GOTO 250
280 '
290 PRINT THE.BASE.% ; "is the number base"
300 PRINT DIGITS.% ; "digits of precision"
310 PRINT "Rounding is " ;
320 IF ROUNDING.% = 0 THEN PRINT "NOT " ;
330 PRINT "done."
999 SYSTEM
```

Figure 1: A BASIC program that investigates the floating-point format.

```
10 INPUT "Number base ? ", BASE
20 INPUT "How many digits ? ", DIGITS
30 FACTOR = LOG (BASE) / LOG (2)
40 PRINT "One digit in this base equals";
50 PRINT FACTOR ; "binary digits"
60 PRINT "Equivalent binary precision is ";
70 PRINT INT (FACTOR * DIGITS + .5 )
80 GOTO 10
```

Figure 2: A BASIC program that converts the precision of any base into its binary equivalent.

your calculations in terms of pennies, not dollars, so that the number 100 represents 100 cents, not 100.)

Completing the calculations, I found that *Framework* figured its numbers to 18 digits and did not round off.
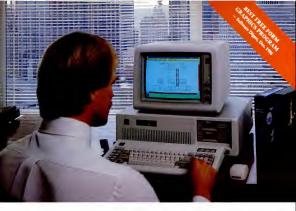
Now, what if we're interested in knowing whose calculations are more precise? It's easy to compare *1-2-3*'s 53 binary digits with BASIC's 24 or 56. Clearly *1-2-3* is much more accurate than BASIC's single-precision, and less so (but not much less) than double-precision.

LOGARITHMIC SOLUTION But how do we compare against *Framework* or any other floating-point format that doesn't use a binary base? The answer is found in the mathematical formula that lets us convert the digits of one base into the equivalent digits of another. It's done with logarithms. Divide the log of one base by the

other and you get a conversion factor—how many digits in one base to give the same precision as one digit in the other. Multiply that factor by the number of digits in the one base and you get their equivalent in the other. Figure 2 shows a simple program that will convert the precision of any other base into the binary equivalent.

Using this program, we find out that *Framework*'s 18 digits in the decimal base are the equivalent of 60 binary digits. So *Framework* gives us 7 more bits of precision (or a little more than 2 decimal digits) than does *1-2-3*. That also further explains why *Framework* calculates more slowly—it's working harder to figure that extra precision.

That's a beginning look at floating-point, from the outside in. Next issue we'll turn things around and snoop at floating-point formats from the inside out. ⌘

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CIRCLE 159 ON READER SERVICE CARD

■ **JIM SEYMOUR**

MAKING THE WORK GROUP WORK

We've learned how PCs make individuals more productive. Now a new class of software, led by Broderbund's For Comment:, is emerging that will make work groups work better.

Quick: What's the Next Big Thing in personal computers? I can think of a half dozen reasonable answers, but I'm placing my bet on the so-called work group productivity software.

We've taken PC hardware way past the limits of software that's available today and is likely to be available in the near future. Optical disks are slowly building momentum, in a process that seems to defy all human efforts at acceleration.

And existing single-user productivity software has settled into comfortable if narrow-minded categories, with a few dominant products in each and relatively little opportunity for newcomers. The probability of a new "hot" single-user software category appearing in the foreseeable future—the way PC, CAD, outlining software, and project-management software emerged 3 years ago—seems very small.

Present-day PC software has done amazing things for the single user, providing leverage in productivity, creativity, and personal development.

Now it's time to bring PC-based tools and leverage to our immediate work groups, those people with whom we are in contact much of the workday. The old 80/20 Rule holds true for most of us: at work, 80 percent of our direct and important communications are with maybe 20 percent of our colleagues. (And when the rule fails, it's usually because the ratio is more like 90/10 or 95/5.)

Ergo, it's time for work group productivity software, which is just starting to appear.

Have you seen *For Comment:*? It was shown privately just before last fall's Comdex and appeared in public for the first time on the floor of the show. I have trouble finding people who've even heard of it, but take my word for it: once you see *For Comment:*, you'll be impressed. *For Comment:* is destined to be remembered as the first of this new breed of programs designed to help a *group* work together more productively.

TRACKS REVISIONS In the simplest view, *For Comment:* is a tool for tracking revisions in text documents. It allows each of several reviewers or coauthors of a work to annotate the text with questions, suggestions, and proposed new text. Excisions are saved and identified, so it's possible to take a *For Comment:*ed document back through a long trail of changes, deletions, and additions.

Each coauthor's or reviewer's work is identified by his or her name and initials, with color-coding of additions and deletions to identify a change's source.

The primary author (that is, the originator) of a work prepares a first draft, then uses *For Comment:*'s Author Disk to read a native-format file from *MultiMate*, *WordPerfect*, *WordStar*, or most other word processors' ASCII output into a *For Comment:*-format file, and to create a list of reviewers.

That file is then circulated to those reviewers, accompanied by a subset of the program that allows them to add comments but not delete others' remarks and additions.

You can buy a "single-author" version of *For Comment:* for $195. Users of this version will have to pass the Reviewer's Disk provided with the package around to colleagues, along with a data disk containing the document and revisions.

A NETWORK NATURAL The program cries out to be run on a network, to avoid that Floppy Frisbee routine. And Broderbund has a LAN version, for IBM, 3Com, and Novell nets, at $995. Put *For Comment:* on a network, and passing a document through several rounds of revisions is a delight. (And with the network version, anyone can become an author, originating documents and creating reviewer lists.)

I said that in the simplest view, *For Comment:* is just a tool for tracking changes in documents. But put it on a network and tie it into a group working together and you have a powerful facilitator and motivator for getting that group in-

■ JIM SEYMOUR

volved in producing the best possible document. The kind of fast feedback and ping-pong exchanges it provides are clearly what making small groups—as opposed to only individuals—more productive is all

about. Seen that way, *For Comment:* becomes a lot more than just a text-management tool.

Not all the magic is in *For Comment:*, of course. Local area networks are more

than just a new kind of medium for connecting machines; they quickly become a primary communications system for those who are on the net.

(I'm always baffled by employers who get cranky about workers using LANs for personal messages, such as to set up lunches and golf games. That's a fine way of learning the LAN habit and, when it begins to happen routinely, a good sign that people are accepting the LAN as nothing more nor less than another means of communicating with each other.)

But LANs alone aren't enough. We can swap versions of *1-2-3* spreadsheets on LANs right now, but the process isn't a tenth as interactive as working with text files under *For Comment:*.

■ *For Comment:* is a tool for tracking changes in documents. Put it on a network and you make small groups more productive.

Although all of us could come up with a long list of ideas for exotic work group productivity packages, I'm delighted that the first one to market focuses on joint writing projects.

Just as traditional word processors are easy, natural introductions to personal computers for many—because we all have to wrestle with writing things from time to time, and thus the results of word processing aren't an abstraction—a joint writing-and-review program is a natural and powerful introduction for most users to the idea of making a work group more productive.

Like all good human interactions, working with a group on a *For Comment:* document is fun, and that's the final stimulus to jump in and do well. I find it interesting that *For Comment:* comes from Broderbund, the computer games people. Do they know something Lotus, Ashton-Tate, IBM et al. don't?

■ **STEPHEN MANES**

THE 386 IN FANTASYLAND

The 386 provides immediate, major value to users, easily justifying its premium price. And, say, could you run out to the moon and pick me up some green cheese?

The seminar topic was "The 386: Miracle, Godsend, or Mere Boon?" Movers, shakers, and memory-chip makers were on hand to expostulate on their favorite topic.

I, alas, was not. My chariot was wedged amidst a sea of ancient locomotion lacking even a rudimentary real-time navigational system or accident-avoidance sensor.

Arriving late, I hurried toward the conference room. My friend Olga, the best-looking and brightest analyst in the industry, emerged from the door in the throes of a choking fit. She gasped desperately for air. I reacted like an expert system. With 32-bit speed, I threw my arms around her, made a fist, and yanked it into her abdomen. A large gob of what looked like a partially digested Tootsie Roll flew across the corridor like a rocket and landed with a loud "ping" in a decorative spittoon.

"Thanks," said Olga as her breath returned. "You saved my life, and I will be your eternal debtor. However, the current position of your digits was never recommended by Dr. Heimlich. Unhand me."

My hands dropped to my side. "I didn't think Tootsie Rolls were included on the 'Eat to Get Rich' diet."

"That," said Olga disgustedly, "was no Tootsie Roll. That was a gob of pure undigested stupidity from what some laughingly call the finest minds in the business. I guess it just stuck in my craw. You should hear what they're saying in there!"

"Fill me in."

"You've been to these things often enough to know. They started off with the mutually congratulatory gush of introductions. Then they segued into the truisms."

"Such as?"

"The 386 is fast. The 386 gives you tons of virtual memory. The 386 does lots of important things in hardware to make protected-mode operation simpler. You know: the actual facts."

"Sounds reasonable enough."

SCIENCE FICTION "Sure. Who can argue? Faster is always better. Bigger is always better. Handing off routine drudgery from software to hardware can't hurt. But for the finest minds in the business, that's just the opening chapter. From there they take off into Fantasyland. And they actually seem to think their science fiction stories have something to do with reality."

"Stories?"

"Tales of the forthcoming software revolution. You know, a new wave of software unlike anything since the invention of

the printing press. It'll make computers easy to use. It'll give you untold power. It'll let you boldly step where the hand of man has never set foot."

"Besides the metaphor, what's so fantastic about that?"

"For openers, cost. Bigger and faster may be better, but cheaper is better, too. Do you really need to pay the inflated price for a 386 machine just to put it on some clerk's desk for routine typing? Do you really need to give some junior manager a 386 to do simple accounting? The 386 machines are going to be for special situations and power users until they stop commanding a tremendous premium over plain-vanilla PCs. I wouldn't hold my breath."

"What about multiuser systems and networks?" I asked.

"Fine. But you lose performance. For the individual user, a slower standalone will work faster. Why rush to the 386?"

"Graphics?" I wondered.

"Dream on. Sure, you can do great stuff on these systems, or at least you'll be able to once people come up with standards for the fancy new graphics chips. But graphics takes up huge hunks of storage. At 1,024 by 1,024 resolution in eight colors, you're talking a 1-megabyte image per screen, and eight colors isn't much to brag about. I mean, it's hard to take graphics seriously when a 36-exposure roll of color film holds more information than a 40-megabyte hard disk. For CAD/CAM and maybe desktop publishing, okay. For the rest of the world, forget it."

"Protected-mode multitasking will be important, though."

Illustration: Daryll Cagle

■ STEPHEN MANES

"Sure," Olga snorted, "for the small number of power users who really need it. But data entry clerks and secretaries have enough trouble trying to work with one program at a time. You think they're going to want to juggle electronic mail and spreadsheets in background mode while they're grappling with their word processors?"

"But everybody says the new programs developed for the 386 machines will be really easy to use. You could have virtually unlimited context-sensitive help."

"Where are these programs going to come from? Say you're developing a new word processor. Are you really going to write one that'll only work on 386 machines and thereby cut yourself off from a market ten times bigger?

"And where are you going to put all this help? On a huge hard disk. Which costs money. So maybe it's not so terrible to have a program whose help system suggests you consult the manual now and then. Besides, the types who use 386 machines as macho fantasies couldn't care less about help screens."

"So what's your scenario for the 386?"

POWER ABUSERS "The 386 machines will sell to power users—insecure managers who can't bear the thought of not having the most powerful unit in the division on their own desks. They'll be dandy for special applications and situations where speed is important. But until they, and all the fast peripherals they need, get a lot cheaper—which will take a good long while—there won't be a big rush to develop anything but highly specialized software for them. Besides, it takes a couple of years of floundering around until people figure out how to write good stuff for new operating systems anyhow.

"What might—and I emphasize *might*—eventually start a 386 revolution is a dazzling program that everybody just has to have but that can't be made to work on any lesser configuration: in other words, the 386 machine's equivalent of *VisiCalc* for the Apple or *1-2-3* for the PC. And that doesn't mean an operating system or something like *Microsoft Windows*. You don't buy a computer to run an operating system or a user interface. You buy it to run applications."

The door to the seminar room opened. The movers and shakers came out looking like Snow White, Tinker Bell, Jiminy Cricket, and Captain Hook.

"See?" said Olga. "Fantasyland!"

Winnie-the-Pooh came over to ask if we had caught his oration about "The Software Honey Pot."

Olga smiled. "You see that spittoon over there?" ⚡

GbsSlpBack-001B

Back

1. Follow instructions on the other side

d overnight delivery

The me
always the

– 192K RAM. For all its pluses,
networking has a minus.

– 66K RAM, – 128K RAM, – 128K RAM.
A word of warning: Too
many pop-ups can have a
negative effect on your memory.

– 320K RAM. Windowing can give you a whole new
outlook. It can also gobble up a whole lot of memory.

mory is first to go.

- 128K RAM. Everyone will tell you downloading is where it's at. Which is why expanded memory is where you should be.

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■ STEWART ALSOP

A HOT, NEW ACRONYM: KLANSS

Amid all the industry focus on local area networks' technical specifications, it's been forgotten that no matter how fast a network runs, it still can't run itself.

K LANSS: An acronym that means "Keep that Local Area Network Simple, Stupid."

Novell and 3Com have been shooting at each other over who's got the fastest network. AT&T wants you to think that setting up a StarLAN is a snap since it uses telephone wiring for connections. IBM has been trying to establish its Token-Ring Network as the standard network system. At least 15 other companies tout their proprietary networking systems as standards. Computers based on the 80386 chip are being touted as excellent file servers for local area networks. Microrim is trying to give Ashton-Tate gas pains by selling its new *R:base System V* as the only database system that doesn't need special and more-expensive software to run on a network. Oracle Corp., Informix, and Relational Technology are pitching a new concept of widely networkable databases that use the SQL query language from IBM.

Meanwhile, not as many people have bought networks as market researchers would have had you believe just a year or two ago. What went wrong on the way to networked nirvana?

NOT SO HOT As usual, manufacturers have forgotten to consider the poor, dumb user who's got to deal with all this stuff. Indeed, the network manufacturers are acting entirely too much like minicomputer companies when it comes to designing and selling local area networks.

Local area networks wouldn't be a hot item in the PC industry if it weren't for the development of personal computers. Be-

fore PCs came on the scene, all of the computing intelligence (meaning processing power, memory, and wideband I/O) resided inside a central computer to which was attached a bunch of screens, appropriately called dumb terminals. This was a fine model for certain kinds of computing, mainly batch- and transaction-oriented data management.

When personal computers arrived, they created a different model of computing, in which interactive, personal applications like financial analysis, personal record keeping, and letter and memo writing were appropriate. Around 1983, local area networks began to be pitched seriously as an ideal method for bridging these two models of computing, so that individuals would have access to company data and the company database could capture all the data flowing around.

But most networking companies have been working under the vague assumption

that personal computers can't really be hooked into a system without giving up some of their inherent independence. That means that the network system must be able to keep up with the rest of the corporate system and that basic control of the system must reside centrally, with the information management group or its equivalent. This sort of approach has focused the debate over various approaches to LANs on issues such as speed (4 megabits per second seems to be acceptable), configurations (star, bus, ring, etc.), media (twisted-pair, coaxial, etc.), and protocols (NETBIOS, APPC, LU 6.2, TCP/IP, MAP, TOP, and on and on).

POOR USER Meanwhile, the poor, dumb user has been scratching his head, wondering what all the fuss is about. Nobody explains to this guy that he'd be able to use a laser printer to make great-looking letters because networks can let several people share one of these expensive printers, bringing the cost per user down to an acceptable level. Nobody tells this guy about being able to send a message to all of his coworkers without having to print it out, walk to the copier (which is probably out of toner or has a paper jam), and then stick a copy in everybody's in box. Nobody talks to this guy about being able to read a file from a coworker's hard disk without having to ask for a copy of it on a floppy disk so that he can see what the latest version of next year's budget is or what progress has been made on the business plan for a new business unit.

Instead, what everybody talks to this

■ STEWART ALSOP

guy about is whether 4 megabits per second (Token-Ring) is sufficient or whether you need 10 megabits per second (Ethernet). What everybody gets really heated about is whether you have to tear the walls down to cable your office with Teflon-shielded coaxial cable and, if you do, whether a star or ring configuration is best.

If I remember correctly, the basic reason that PCs were so appealing in the first place was that they were relatively simple, easy-to-understand machines that poor, dumb users could understand and get useful work out of. The very first widely available personal computers ran at a blistering rate of about 1 or 2 MHz, had 40-column screens with all-uppercase characters, and about 16K bytes of memory. And yet hundreds of thousands of people bought these ungainly, primitive machines and found useful things to do with them.

It strikes me that before we can get to the point of using networks that run at 10 megabits per second with 25 computers connected by coaxial cable, we need a simple, slow, inexpensive way to connect people's computers to hard disks and printers. And the reason we need such networks is so that users—the people actually using this stuff, not the technical gurus, purchasing managers, or data processing people—can figure out what it is they're buying, why they want to buy it, and what they'll do with it once they have it.

A few such networks already exist: EasyLAN from Server Technology in Sunnyvale, California, and MultiLink from The Software Link in Atlanta, Georgia, both connect computers, hard disks, and printers through a serial port and some inexpensive cabling and software. Neither is a speed demon (EasyLAN runs at 19,200 bits per second, while MultiLink Advanced transfers data at 115K bps), but both are easy to use. (They emulate DOS, which most people have unfortunately had to learn.) I particularly favor the approach of TOPS from Centram Systems West in Berkeley, California, which requires a board and Appletalk cabling, but also emulates DOS, runs at 232 kilobits per second, can read files directly off a connected hard disk, and gives you access to Macintoshes (should you want such access).

All of these networks can be installed by users; all are simple to operate; all let you share laser printers and hard disks; and all cost less than $200 per computer.

Once people have figured out how to use these relatively simple, low-performance products, then they'll be ready to graduate to the macho networks everybody else talks about. And they'll be ready to understand the issues from personal experience, instead of being buffaloed by technical gurus.

Now There's A Management Tool That Lets You Work More Efficiently... Without Changing The Way You Work. Lotus Metro.

Lotus® Metro™ is a memory-resident program that combines the powerful efficiency of 12 business management tools with the time-saving convenience of macros.

Metro gives you more ways to get your work done. Metro has the same command and menu structures as 1-2-3® or Symphony® so you already know how to use it. And since it's from Lotus, you can count on its high quality and reliability to let you start working more efficiently—and in complete confidence—right away.

In fact, when you consider everything Metro can do, you won't believe its low price—just $85.

The Most Comprehensive Product Of Its Kind.

Metro lets you handle daily tasks on your PC more quickly and easily than ever before. You'll simplify routine—and complicated—jobs. Handle workflow interruptions more effectively. Organize your day.

In short, you'll become more productive by minimizing the time you waste.

Bring All Your Work Together.

You can customize Metro to your needs by choosing any of the following management tools:

- *Clipboard* lets you easily move data and text between 1-2-3, Symphony or other software products—as well as between the Metro management tools themselves.
- *Appointment book* keeps track of your schedule.
- *Phone book* compiles names, addresses and phone numbers—and can even dial your phone.
- *Calculator* includes memory and financial functions.

- *Notepad* lets you jot down quick ideas and memory-joggers you can retrieve at the touch of a button.
- *Editor* creates business letters and spreadsheet reports, and allows you to view and edit existing files.
- *List manager* orders daily tasks, and effectively segments/tracks "to do" lists.
- *Watch* helps you keep records of time spent on as many as 100 different projects.
- *DOS file manager* executes DOS commands from within applications.
- *Kaleidoscope* specifies colors on your screen, *Configuration* lets you build the product that best fits the way you work, *Special characters* contain a full 256 character IBM extended ASCII table.
- And *Macros* let you turn even your most complicated multi-step tasks into one-step commands.

High Quality... Total Compatibility.

Metro is built to the high quality standards of 1-2-3 and Symphony—so it won't endanger your data. Metro is unprotected, so it's easy to install and easy to use. And it can be easily removed from memory whenever you need more room for your spreadsheet or other functions.

As a member of the Lotus family, Metro is the management program best suited—and designed—to work with other Lotus products. And it comes complete with Lotus' unparalleled commitment to customer service, reliability and support.

Charting A Course Through
GRAPHICS
SOFTWARE

Snazzy
graphics are a powerful,
multidimensional business tool.
A single beautiful graph can
illuminate the relationships between
numbers, helping you analyze data.
It can communicate those relationships to
your peers, superiors, or clients.
And that same graph will impress
viewers with your professionalism.

Good graphics have always performed
and will always perform those
functions. But, as with everything
they touch, PCs and software
have changed the way you can pro-
duce graphics. While you once
might have spent hours cutting and
pasting charts together or relied
on production houses or art
departments to create the graphics
for those charts, you can now
use graphics software to produce
charts yourself, saving hours and

Business success and graphics go together,
and in today's business environment,
graphics increasingly means graphics software.
For this reason, PC Magazine devotes an
entire issue to this subject and helps
you chart your way to the PC-based graphics
solution most suited to your budget
and your needs.

dollars in the process. Creating graphics in-house using software will also help you keep sensitive data under wraps.

But beware: just as using word processing software won't make you a better writer, using graphics software won't make you an effective graphics designer. And if you aren't already artistically inclined, you'll find that most graphics software vendors offer few guidelines as to how to use graphics programs to their best effect. At most, the documentation will include a brief discussion of good graphics design, and some packages come with useful settings that should keep you from making any hideous blunders. The sidebar "How to Make Your Point with Punch" will give you some tips on how to design graphics effectively. You could also go to a production house or service bureau and ask them to spruce up a rudimentary chart, or even to take your data and create an entire presentation for you. For more information on service bureaus, see "Producing Quality Output: When Only the Best Will Do."

Should you decide to proceed with graphics software, you'll quickly discover that you have a wide array of choices. This special issue of *PC Magazine* is designed to help you cut through the confusion and zero in on the product that best suits your business application.

MARKET FORCES Graphics software has been available for years. But a lack of hardware standards has until recently slowed its proliferation. The first stab at a graphics standard came 3 years after the introduction of the PC, when IBM introduced its Enhanced Graphics Adapter in September of 1984. Although far from perfect, the EGA can display an acceptable number of colors with a high enough resolution that it can show readable text in one or more colors. The Enhanced Graphics Adapter allows for the display of 16 colors at a resolution of 640 dots by 350 lines (it can also display graphics written for the older Color/Graphics Adapter at that adapter's four-color, 640 dots by 200 lines and 320 dots by 200 lines).

But price was the major roadblock to the EGA's widespread acceptance. When you included the 256K bytes of memory necessary for displaying complicated images rapidly and for scrolling images across the screen smoothly and quickly, the EGA cost nearly $1,000. It was the September 1985 introduction by Chips and Technologies of its EGA CHIPSet—a set of 4 chips that handles the functions of 19 of IBM's proprietary chips on the EGA—that set the standard on its way to widespread acceptance. By November of that year, more than half-a-dozen companies had introduced EGA-compatible boards based on Chips and Technologies' EGA CHIPSet. And these new boards averaged a more affordable $600. Currently, you can get an EGA compatible for about $300. For a review of some of these low-cost EGA compatibles, see "The Enhanced Graphics Standard Comes of Age," *PC Magazine*, Volume 5 Number 14, and "Stretching the Standard: Seven New EGA Boards," *PC Magazine*, Volume 6 Number 1.

As an example of how widely the standard has been accepted since its introduction, three-quarters of the software packages reviewed in this issue are EGA compatible. As a result, graphics software is becoming more accessible than ever to the average business user. And the recent announcement of IBM's new generation of PCs (due out this year), which will include EGA chip sets right on their motherboards, should give graphics packages an even greater boost.

While these changes could well herald an explosion in the graphics marketplace, the market isn't quite there yet. Like other young software markets, graphics software has both shining stars and rough edges—some of which encompass whole products or different parts of the same product. Finding the right product in such a market can be particularly frustrating and confusing.

GRAPHICS SOFTWARE To help our readers, we've narrowed the field of graphics software covered in this issue to those packages which are most suitable for general-purpose business use. An informal poll of reviewers then revealed that they typically use graphic software for three main purposes: analyzing and interpreting numerical data, showing their findings informally to their peers, and then using their findings in presentations on a more formal basis to others in their own companies or to

Like other young software markets, graphics software has both shining stars and rough edges—some of which encompass whole products or different parts of the same product.

HOW TO MAKE YOUR POINT WITH PUNCH

A beautifully designed graphics presentation can help you make your point with punch and make a good impression at the same time. But you should also beware: poorly designed graphics can be downright embarrassing.

These tips will help you steer clear of graphics gaffes and make your presentation as effective as possible.

CHOICES OF CHART TYPES

■ An area graph is a line graph in which the area under the horizontal line represents a quantity. You can use this type of graph to show elapsed time and the area under the curve to represent cumulative value.

■ Bar graphs show relationships or comparisons between variables. While you may position bars horizontally or vertically, all the bars should be the same width. If used in pairs, the bars should touch and the spacing between each pair should be equal. To distinguish the bars, use different colors, tonal variations, hatching, or dots.

■ Pictographs are used for the same purpose as bar graphs, except that you use symbols from your software's clip art library instead of bars. Each symbol represents a size unit, for example, 10. Rather than doubling the size of the symbol, use two of equal size to show a unit of 20.

■ Line graphs show the differences between variables. You can use them to show percentage differences between groups, as well as frequency or distribution of a group. They can demonstrate the rank of an item and show magnitude or movement. To differentiate between the groups, use solid, hatched, dotted, or colored lines.

■ Pie charts show the way in which various parts make up a whole. The whole is always 100 percent; the pieces represent the percentages made up by the different parts. You might use them, for example, to show the various sources of your profit. The most effective way to arrange the pieces of the pie is to place the largest wedge at the top, the other pieces clockwise according to size. The largest slice should have the lightest tone, with each smaller piece becoming progressively darker. The wedges may be named and numbered. For emphasis, separate one slice from the remaining portions.

■ Organizational charts demonstrate positions or rank within an organization. Center each name within a rectangle, with lines connecting each related position. Rank order is indicated from top to bottom or left to right, with equal ranks being on the same level.

■ Sociograms or nets show how groups interact. You show relationships by using lines. Arrows indicate the direction of interactions. If you wish, you can place numbers above the lines to indicate frequency of interactions.

GRAPHICS LAYOUT POINTERS

■ Make sure that your data is completely correct. (You'd be surprised how many times *all* the percentages don't add up to 100.)

■ Use as few words as possible.

■ Position words so that they read from left to right.

■ To emphasize a point, use capital letters, bold typeface, italics, underlining, increasing size, color, or texture.

■ Use headings to clarify the topic you are addressing with your graphic and make sure that headings are consistent throughout the presentation.

■ To make sure your charts are legible, use a simple, clean type style such as Helvetica. Don't crowd the information together or put too much data into one graphic. Instead, break apart the information into concepts that can be quickly and easily grasped, using a different graphic if necessary. Leave lots of white space around text and graphics.

■ Consider the distance from which your audience will view the presentation. Do a test run to see whether the size of the material is legible at that distance.

■ Text can be centered, or left or right justified. Margins should be consistent throughout the presentation, wherever possible.

■ Borders "frame" the presentation. You may use solid, heavy black, or colored lines, two or more parallel lines, and tones or textures to fill them in. But remember, when you make borders be sure you use them consistently.

■ Colors should be chosen with the document and audience in mind. What might be nice for a neighborhood newsletter wouldn't necessarily work for the CEO of a corporation. Keep the number of colors limited on the graphic, and remember that some colors (blue and green, for example) appear "heavier" than others (such as yellow and orange). If possible, arrange heavier colors below lighter ones.

■ Composition is what makes a page look good. Good composition involves leaving adequate margins around the artwork. Remember that if the page is bound on the left side, you'll need to allow extra space to make the left and right margins visually equal. Generally speaking, bottom margins should be larger than top ones, especially if you are making a border around the design. You should also use care to ensure that the "visual weight" of the text and graphics looks balanced, with each relating to the other and enhancing the other. If all else fails, look at attractive layouts professionally prepared and model your composition after them.

While these points won't make you a graphics expert, they'll get you going. But before you go, remember the last and Golden Rule of Graphics: "When in doubt, leave it out."—**Diana Goldberg and William McLeod**

Diana Goldberg, M.A., and William McLeod, Ph.D., are principals of Technologie Ltd., an interior and graphics design firm with offices in Somers and Woodstock, Connecticut.

outside clients. All of these uses have one important thing in common: data. We therefore concentrated our efforts (with a few minor exceptions) on graphics software packages that allow you to either key in or import data and graph it. To communicate your findings with others, you naturally need some form of output. Therefore, we selected only those packages that can output to printers, plotters, or film recorders.

We included only standalone packages; we did not look at utilities that required the use of another package. We excluded products designed for very narrow markets, such as investment software charting packages as well as CAD, paint, and freehand drawing programs. Some of these, such as investment software and CAD packages, will be covered in other roundups. And while you can make effective business graphics with paint and freehand drawing programs, you must actually draw the graphics on your screen with them. As a result, they require a great deal of artistic expertise.

INTEGRATED PACKAGES Analyzing and informally presenting data do not require fancy graphics capabilities. If that's all you need, the graphics of integrated packages such as *1-2-3*, *Symphony*, *Framework*, and *Enable* could be all you need. The graphics included in these packages are enough to get a quick feel for the relationship between numbers. Then, once you've made your initial analysis, you can print them out and show them to your coworkers. If you decide to make a formal presentation of your findings, these simple graphs will give you an idea of the best type of graph or chart to use to present your data.

Within this category of graphics, quality varies considerably from product to product. For instance, while Lotus's *1-2-3* offers the graphics that industry watchers love to hate—with a grand total of five graph types and an awkward output method in which you must save the graph to a .PIC file, then go into a separate Print-graph utility—millions of *1-2-3* users think they're just fine. At the other end of the spectrum, *SuperCalc4*, with its luscious 64-color palette, offers more-than-suitable graphics. In the review section

GLOSSARY

Bit-mapped A system in which a consistent number of bits defines each individual pixel of display memory. Bit-mapped systems are used in applications such as paint programs that address individual pixels—assigning each its place on the screen—and specify pixel colors. The limitation of a bit-mapped system is that storing the address and color information for each pixel that comprises an image requires large files, which take up large amounts of memory and slow the time it takes to display your screens.

Crop To select a portion of an image by cutting away parts from its edges.

Draw program See Object-oriented.

Object-oriented (vector graphics) A programming system that keeps track of graphic elements as complete geometric objects, such as circles and rectangles, rather than as individual pixels. Object-oriented systems require less memory than pixel-oriented systems because they store instructions for the placement of entire objects, rather than for the individual pixels comprising the objects. Object-oriented systems are also more flexible because you can perform calculations on the instructions. So you can, for example, easily enlarge or decrease the size of an object using commands. The drawback is that these systems are unable to perform detailed editing of individual pixels.

Paint programs These are bit-mapped systems that offer the flexibility of individual pixel editing and can make use of the maximum color possibilities from the graphics hardware. In most cases, the number and type of colors that a paint program can use are limited only by the number of pixels that your monitor can display. Paint programs are usually easy to use but require some skill if you wish to do precision work.

Palette The number of colors available from the graphics display hardware.

Pan In computer graphics, to move an object from side to side or up and down.

Pixel The smallest point that can be displayed on the screen. All screen images, including text and graphics, are made up of combinations of pixels. *Pixel* is a contraction of "picture element."

Polygon An area defined by three or more connecting line segments.

Raster graphics See Bit-mapped.

Resolution The fineness of detail that is shown in a display. Resolution is usually expressed as the number of vertical pixels on your screen times the number of horizontal pixels.

Texture A cross-hatch, speckle, or other pattern that can be used to fill an area in a drawing or diagram.

Translate To move a graphic object without rotating it or changing its size.—**Gerard Kunkel and Steve Rosenthal**

Steve Rosenthal is a free-lance writer based in Berkeley, California.

that follows, "Graphics Software on Display," we group these integrated packages side by side in alphabetical order by product name for easy comparison.

DEDICATED CHARTING Once you've analyzed your data and decided on a format for presenting it, you'll want to make a presentation that will leave a lasting impression. Dedicated charting programs will accept data, either from the keyboard or by importing it from another package—such as an integrated program—and will create a graphic presenta-

tion. Since these programs concentrate on one task, they often offer more features than the integrated packages. Most provide various type fonts in many sizes and weights to help you dress up chart legends and labels. They offer hatching patterns to fill bars and pies in a visually appealing fashion. Some even offer libraries of art that you can copy and use to spruce up your images. The dedicated charting program also has a broader range of output support than the integrated packages. While they can output to dot matrix printers, laser printers, and plotters, most also

include the necessary drivers for high-resolution film recorders.

Again, products in these groupings run the gamut of quality and functionality. And price does not necessarily coincide with either. Some packages with roots in the mainframe world, such as Execucom Systems Corp.'s *Impressionist*, offer near-impossible interfaces for PCs users. Others, with their ease of use and flexibility, herald what we hope will be the shape of all graphics software packages to come. For example, Software Publishing Corp.'s *Harvard Presentation Graphics* provides extremely easy-to-use, high-quality graphics, though at the price of some flexibility; Lotus's *Freelance Plus* offers a broad range of abilities—mapping, text and organizational charting, large clip-art libraries, innovative scaling techniques, plus drawing and painting capabilities—all in a single package.

You'll find reviews of these dedicated charting products grouped in three price categories: under $100, $100 to $499, $500 and over, and arranged alphabetically by product name in the review section that follows.

ANIMATED PRESENTATIONS Unlike other applications such as word processors, for which you can use the same old products year after year, successful graphics presentations depend on novelty. To put your best foot forward and keep your audiences involved in your presentation, you might want to add some life to your presentations, literally. "Animated" presentation programs integrate a variety of attention-getting features. Typical features include slide show, animation, sound, paint, and charting programs, as well as a library of prestored images. Some packages, such as *Show Partner*, can even act as shells that allow you to call up and use other programs without leaving the software.

These animated packages combine presentation tools. You can show presentations created with such packages in a number of ways: you might display them on a computer screen, direct them to board room video projectors, or transfer them to an image recorder to create a conventional 35mm slide show. For a review of some of these packages, see "Wipes, Pans, and

Fade-outs: Animating Your Business Graphics" in this issue.

SPECIALIZED GRAPHICS If you have highly specialized business needs such as for Gantt charts, flowcharts, or organizational charts, a general-purpose presentation or analytical graphics package may not adequately fill the bill. Although this category of products does not necessarily plot data, we included it in our survey of business graphics packages because these products accomplish useful though often neglected tasks for business people. Specialized packages offer these specific features or do a better job of furnishing them than a standard package does. For a review of these, see "Specialized Graphics Software: The Quick and Clean Solution" in this issue.

PRODUCING QUALITY OUTPUT According to a recent study by 3M in conjunction with the University of Minnesota, using 35mm slides to present your graphics causes viewers to perceive your presentation as more professional. So if you want your presentation to pack the most punch, (and who doesn't) your best choice is to use slides. Once you use one of the packages reviewed here, you can create output in two ways: use your own film recorder or go to a service bureau. If you have sensitive data and/or produce large numbers of slide shows, purchasing your own film recorder or screen camera could be the best option. For a discussion of the features to consider and a look at three new products, see "Producing Quality Output: Three New Film Recorders." If you don't want to go to the trouble or expense of purchasing your own film recorder, you can still use your graphics software to create high-quality slides. "Producing Quality Output: The Service Bureau Option" sends you on a whirlwind tour of service bureaus that do everything from putting together slides that you've produced with your graphics software to turning your data into fancy graphics.

This issue is designed to give you a full palette of tools for your business graphics needs. The features tables and reviews that follow should lead you to the precise product that will fill your business graphics needs. ∎

GRAPHICS
SOFTWARE
On Display

I f you
want to use graphics software
to analyze and present data, you'll
want to zero in on integrated and
dedicated charting packages.

The graphics capabilities of
integrated packages such as *1-2-3*,
Symphony, *Framework II*, and
Enable are designed primarily
to help you analyze data
and quickly see the relationships
between data. Most of these
packages offer only rudimentary
graphics, with just a few chart
types, colors, fonts, and so
forth. Their output is also simple
fare. While all have drivers for
printers, plotters, and low-resolution
film recorders such as the
Polaroid Palette, only *SuperCalc4*
has drivers for a higher-
resolution device.

Do you need graphics software to do quick
and dirty analysis and to present the results to
others? Then you'll want an integrated
package with graphics capabilities or a dedicated
charting package. We review and chart the
features of 44 such packages. More importantly, we tell
you what to look for and interpret what those
features mean for various types of users.

GRAPHICS SOFTWARE ON DISPLAY

Hardware and software together determine the number of colors and the resolution of graphics output. Most of the packages have drivers for several output devices.

But even though these packages offer only the basics, if you already own one or only need to analyze data, these packages could be all you need.

If you don't have a spreadsheet or need higher-quality graphics than an integrated package can provide, consider a dedicated charting package. Because these packages provide only graphics capabilities, you'll find a wider array of graphics features than in the integrated packages. For instance, most offer several type fonts and hatching patterns to fill the graphics.

These packages also have the drivers necessary to support a wide variety of output devices, including high-resolution film recorders, that will allow you to produce beautiful, high-quality output.

HARDWARE REQUIREMENTS In order to display and produce output with any of these packages, you'll need the proper hardware. About three-quarters of the packages reviewed in this article support the IBM Enhanced Graphics Adapter, but others only support the CGA. Although not every package fully takes advantage of the hardware's capabilities, for the most part the number of colors and the resolution are determined by the adapter and display.

The higher the resolution, the sharper the image. Resolution is most often measured by the number of lines that make up the image in a raster display on the CRT. IBM's Color/Graphics adapter can display four colors in resolutions of 640 dots by 200 lines and 320 dots by 200 lines. The Enhanced Graphics Adapter displays 16 colors at a resolution of 640 by 350. Specialized high-resolution adapters are capable of supporting more colors at higher resolutions.

Hardware and software together determine the number of colors and resolution of graphics output. Most of the packages have drivers for several output devices. In addition, in some cases, you can purchase optional utilities that allow you to output to devices not supported by the package directly. A dot matrix color printer ribbon typically has 3 colors plus black and can produce about 14 colors. For more information on printers, see "The Third Annual Survey: Printers," *PC Magazine,* Volume 5 Number 19. Plotters use from two to ten

pens, and produce a corresponding number of colors. If you're interested in learning more, see "Adding a Touch of Color: 24 Plotters, $399 to $5,950," *PC Magazine,* Volume 4 Number 26. Film recorders can produce anywhere from 200- to 8,000-line resolution and can, theoretically, produce an infinite variety of colors (the practical limit is about half a dozen). Three new film recorders are reviewed in this issue.

You'll find the listings of the adapters and output devices supported by each product in the *PC Magazine* fact files that are located next to the reviews of each product.

OUTPUT You'll want to see for yourself the output you can expect from each package. Therefore, *PC Magazine* asked each reviewer to create the best-dressed pie chart possible using the package. Special effects used include multiple pies per page, 3-D effects, and the use of clip art to dress up the chart. The reviewers produced the charts using the highest quality/resolution device that the package supports. For many of the integrated packages, this was a plotter. The standard plotter used in testing was the HP 7470A. For packages that used both a Polaroid Palette and a plotter, we chose the output that looked best. Other packages output to dot matrix printers, laser printers, or film recorders. The output device is specified in the captions.

We also include a life-sized detail of a pie chart so that you can see how well the package controls the plotter or printer if the package cannot support a plotter. Poor support translates into jaggedness, good support into smooth curves. For instance, you'll notice that *Harvard Presentation Graphics* controls the plotter extremely well, producing beautifully smooth curves, while jaggies are quite noticeable on curves produced by GSS-Chart.

HELPFUL FEATURES TABLE To help you judge whether the product has all the features you could hope for, *PC Magazine* has assembled a comprehensive table of features, which you'll find located at the end of this article. The following is an explanation of the features in the table and the importance of each feature to you.

Your primary graphics tools are the var-

ious chart and graph types offered by the program. While all of the products offer the basics: bar, pie, and line charts, you might want to add 3-D effects or remove a slice of the pie chart for emphasis.

Some packages also offer specialized chart types. Scatter charts plot points in which x is the value and y is the cost, with the purpose of finding points that offer the best value for the cost. An area chart is a line graph in which the area under the line represents a cumulative value. If you look at weekly stock trends or anything that varies within a range over a discrete time period, you'll need a high-low chart. Gantt charts look like horizontal bar charts and help you visualize how projects are progressing toward a goal. Organizational charts show the rankings of people within an organization.

Having a variety of fill patterns will help you produce visually interesting graphics. And if you're using a monochrome monitor or producing black-and-white hard copy, the fill patterns will distinguish different data areas.

The ability to manipulate chart legends and labels gives you flexibility in their placement and length.

With 3-D programs entering the market, a chart can have up to three axes, the third axis being z. The ability to rotate axes is particularly helpful when using 3-D charts because it allows you to position the chart in the way that permits the clearest view of all the data.

Being able to manually adjust the x and y axis is useful when you want to use the graph to make a point. For instance, compressing the x axis will emphasize peaks and valleys, while extending it will smooth them out.

Even if you're not artistically inclined, you can still dress up your packages with artwork if your package offers a library of images that were created by artists. You can copy images from this library and insert them into your charts and graphs.

Words and numbers are necessary for interpreting charts and graphs. By varying type fonts and using different type sizes for emphasis, you can make your points more clearly. While some packages limit you to just a few font sizes, others provide unlimited numbers of font sizes. "Unlimited" means that you can enlarge or decrease the

size of the fonts in infinite gradations.

You may find that putting more than one set of data on the same axis will not fairly represent each set of data. For instance, if earnings increase dramatically, while profits rise relatively slowly, you won't want to plot the two on the same set of axes; the scaling required for earnings will make the different profit levels difficult to distinguish. You may, therefore, wish to create different charts to clearly distinguish each set of data and to place both charts on the same screen for easy comparison. While most manufacturers limit the number of charts per page, others give no limits other than the obvious practical ones.

For business users who are not artists, paint program capabilities may not be important. But such capabilities will allow artists to dress up a chart, adding impact to their presentation.

If you need to support written reports with graphics and you don't want to cut and paste pieces of paper, look for a package that can export graphics to a word processor. If your package doesn't have that capability, Inset 2 from the American Programmer's Guild (in Danbury, Connecticut) can. It costs $99.

MORE IMPORTANT FEATURES

One way around limitations resulting from the screen display's size is to create a virtual page, which is larger than what you can see on the screen, in the computer's memory. Accessing the off-screen image is done by panning across the image in memory and redisplaying the new section of the image. It's like looking at a newspaper page through a magnifying glass: you see only a small area of the page enlarged at one time, and so you must either move the page or move the magnifying glass in order to see the rest blown up.

User-definable formatting capabilities afford you flexibility. For instance, the labels on a particular chart may be extraordinarily long. A program with only predefined formats might limit the amount of text you can use for the label, resulting in truncated text. On the other hand, by limiting your choices, predefined formats allow you to chart information more quickly. Ideally, therefore, the package should offer both, allowing you to create a chart

quickly if you wish, but affording you the flexibility you need to customize your charts.

Creating a graphics display involves nothing more than carrying out a series of mathematical calculations. Therefore, we looked at whether the packages can use a math coprocessor to speed up the operation of your package, saving you from annoying waits while your package draws or changes an image.

The available resolution and the number of on-screen colors depend largely on the type of graphics board and display, and

Even if you're not artistically inclined, you can dress up your graphics with artwork if your package offers a library of images that were created by artists.

the colors available for output are also device dependent.

The package's data import compatibilities could be a crucial factor in your decision to purchase a graphics package. If you're planning to use a spreadsheet or database program that you already own, you'll probably want to be able to import its data into your graphics package, without reformatting. Some packages will allow you to import data, but only if you use a separate utility to perform the data import. The use of such a utility introduces another time-consuming step in the process of converting data into your graphics program.

Because graphics programs contain complex algorithms that carry out specific operations for the creation of a graphic image, they tend to be very large. You therefore need to consider the size of the program to make sure your system has enough memory. We've reported the file sizes of both the program and the images it stores.

OUR REVIEWERS

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Bruce Brown is a principal at Soft Industries, a Connecticut computer consulting firm. He is the founder of the Connecticut Computer Society and has taught business uses of computers at various area colleges.

Marvin Bryan is vice president of research and strategic planning at a leading national advertising agency and supervises microcomputer operation in his department. He is a member of the American Statistical Association and a frequent contributor to *PC Magazine*.

Diane Burns and **S. Venit** own and operate a business graphics and typesetting shop in San Francisco. They are frequent contributors to *PC Magazine*.

David Hoffman is a microcomputer consultant specializing in database and graphics applications. He has trained groups in the use of popular business graphics software, and he has been a member of the New York User Group for

several years. He is a frequent contributor to *PC Magazine*.

Barbara Krasnoff is a former associate editor of *PC Magazine*. She is the author of a book on computers and robotics.

Jon Pepper is a frequent contributor to *PC Magazine*.

Alfred Poor is a principal at Soft Industries and a frequent contributor to *PC Magazine*.

Robin Raskin is a New York–based free-lance technical writer who specializes in education and family computing issues. She writes for a number of computer publications and is a frequent contributor to *PC Magazine*.

M. David Stone is a contributing editor to *PC Magazine*. He is a free-lance consultant specializing in computer communications and has written three computer books.

Phil Wiswell is a free-lance writer based in New York. He writes frequently for *PC Magazine* and runs a computer consulting business.

We obtained these sizes for the total package by running the program SIZE published in "Sizing Up Your Files," *PC Magazine*, Volume 5 Number 1. The stored image was standard across all the packages tested, and we determined its size by examining its directory listing. We found that some packages took up more than 2 megabytes, requiring the use of a fixed disk. If you are dedicating a system to a graphics program, consider a fixed disk of 20 megabytes or more. With image files averaging over 2,000 bytes, even a 10-megabyte fixed disk will fill up quite quickly.

While all of these packages support input with a keyboard, not all support a mouse or digitizing tablet. The documenta-

tion and user interface of each of these programs take different forms. We provide data on all of these so that you can choose the programs with the user interface that suits your work style best.

All in all, our features table gives you a lot of information. For a more subjective look at what the packages are likely to use, how robust they are, and whether our reviewers would recommend their purchase and for what application, read the individual reviews. You'll find them in the section following the features table in four categories: integrated packages, and dedicated packages costing under $100, $100–$499, and over $500. Within each category, products are listed in alphabetical order by product name.

Business Graphics Software: Summary of Features

Product	INTEGRATED SOFTWARE								UNDER $100
	Enable	Framework II	Javelin	MathPlan	1-2-3	SuperCalc4	Symphony	Twin Classic	dBChart
List price	$695.00	$695.00	$199.95	$395.00	$495.00	$495.00	$695.00	$99.00	$99.00
AVAILABLE CHART AND GRAPH TYPES									
Bar	●	●	●	●	●	●	●	●	●
Stacked bar	○	●	●	○	●	●	●	●	○
Overlapped bar	○	○	○	○	●	●	●	○	○
3-D bar	●	○	●	○	●	○	●	○	○
Pie	●	●	●	●	●	●	●	●	●
Pie with removable slices	○*	●	●	●	●	●	●	●	○
Line	●	●	●	●	●	●	●	●	●
Scatter	○	●	●	○	●	●	●	●	○
Area	○	○	●	○	●	●	●	○	○
High-low	○†	○	○	○	●	○	●	○	○
Gantt	○	○	○	○	○	○	○	○	○
Organization	○	●	○	○	○	○	○	○	○
FEATURES									
No. of fill patterns	8	14	7	32	8	3	7	8	6
Chart legends	Manual	Auto	Manual	Auto	Auto, manual	Manual	Auto	Manual	Manual
Chart labels	Manual	Auto	Auto	Auto	Auto, manual	Manual	Auto	Auto	Manual
No. of axes for data	2	2	2	2	2	2	2	3	2
No. of axes that can be rotated	0	0	0	1	6	2	0	0	
Manual axis controls	None	x,y	x,y	x,y	x,y	x,y	x,y	x,y	
No. of images in standard image library	0	0	0	0	0	0	0	0	6
No. of fonts	6	1	1	71	11	8	11	11	1
No. of font sizes	1	4†	1	71	2	1	21	8	1
Max. no. of charts per output page	1	Unlim.	1	1	Unlim.	4	1	1	1
Paint program capabilities	●	○	○	○	○	○	○	○	○
Cut and paste to word processor	●	●	●	○	●	●	●	●	○
Virtual page capability	○	○	○	○	○	○	○	○	○
Predefined formats	●	○	○	●	○	○	○	○	○
User-defined formats	●	●	●	●	●	●	●	●	○
Can use 8087 math coprocessor	○	●	●	●	●	●	●	○	○
COLOR									
Max. no. of colors on-screen	4	16	8	16	4	16	8	4	
No. of colors in on-screen palette	4	64	8	16	4	64	8	16	4
DATA IMPORT									
ASCII, comma delimited	○	○	●	●	○	●	○	●	
ASCII, in columns	○	●	●	●	●	●	○	●	
DIF	○	●	○	●	●	●	●	●	
SYLK	○	○	○	○	●	○	○	○	
.WKS	○	●	○	●	●	●	●	●	
.WK1	○	○	○	○	●	○	●	●	
DBF	○	●	○	●	●	●	●	●	
Other files	VisiCalc	None	None	None	VisiCalc	SuperCalc	VisiCalc	VisiCalc	None
Reads files directly	●	●	●	●	●	○	●	●	
Needs a utility to import files	○	○	○	○	○	●	○	○	
Necessary utilities come with program	○	●	●	●	●	●	●	●	
DATA INPUT DEVICES									
Mouse	○	○	○	●	○	○	○	○	○
Pad or tablet	○	○	○	○	○	○	○	○	○
DOCUMENTATION									
Disk tutorial	●	●	○	●	○	○	●	○	○
Paper tutorial	●	●	●	●	●	●	●	●	●
USER INTERFACE									
Help screens	●	●	●	●	●	●	●	●	●
Context-sensitive help	●	●	●	●	●	●	●	●	○
Command driven	●	●	●	●	●	●	●	●	○
Menu driven	●	●	●	●	●	●	●	●	●
Batch mode	○	●	●	●	●	●	●	○	○
FILE SIZE									
Test image file (bytes)	2,048	1,728	1,084	874	1,110	2,432	1,595	4,278	570
Total program size	1.57 Mbytes	1.32 Mbytes	786K bytes	1.37 Mbytes	1.44 Mbyte	617,303 bytes	1.7 Mbytes	762,880 bytes	94,076 bytes

★ —Indicates Editor's Choice   ● = Yes   ○ —No   N/A = Not applicable   * can't store single images, stores images only in a series.   † Yes, in Version 2.0.

	Graph Business Graphics $99.00	Graph-in-the-Box $97.00	Micrograph $95.00	$100 TO $499 The Benchmark Graphics $199.00	Boardroom Graphics $150.00	Chart-Master $375.00	Decision Graphics $450.00	dGRAPH, f/graph $295.00 (each)	Freelance Plus $495.00	GEM Graph $249.00	GraffHopper $295.00	Grafox $195.00
	6	10	4	5	bar, 6; pie, 4	10	bar, 5; pie, 12	14	18	15	bar, 5; pie, 12	
	Manual	Manual	Manual	Auto, manual	Auto, manual	Auto, manual	Auto, manual	Auto, manual	Manual	Auto, manual	Auto, manual	
	Auto, manual	Auto	Auto	Auto, manual			Auto, manual	Auto, manual	Auto, manual	Auto, manual	Auto, manual	
	3	2	2	2	2	5	2	2	2	3	2	
	0	0	0	0	0	2	0	2	0	0	2	
	x,y	y	None	x,y		x,y	x,y		x,y	x,y	None	
	0	0	0	0	101	10	0	543	12	0	0	
	1	1	1	12	7	4	1	13	1	2	1	
	5	2	3	2	16	1	Unlim.	1	1	1	1	
	5	3	2	Unlim.		Unlim.	Unlim.	3	10	1	4	3
	4	10	4	16	8	8	16	4	13	8	8	4
	16	64	4	64	8	4	64	4	64	16	16	4
	None	None	None	None	O**	None	WRK, WR1	None	PIC, Metafile, WR1	CSV	None	BASIC
	1,518	780	6,400	650	N/A	1,352	28,032	3,957	1,815	2,755	9,660	3,957
	228,801 bytes	153,148 bytes	208,000 bytes	1.3 Mbytes	255,581 bytes	25,210 bytes	1.05 Mbytes‡‡	352,918 bytes	2.5 Mbytes	733,164 bytes	517,000 bytes	350,719 bytes

†Not user definable.   ‡ $15 with HP LaserJet.   § 4 in Version 4.0.   *In Version 4.0 only.   ‡‡On a hard disk.

(continues)

Business Graphics Software: Summary of Features (continued)

DEDICATED CHARTING SOFTWARE

	$100 to $499						Harvard Presentation Graphics		
Product	Grafline	GraphPlan	GraphStation	Graphwriter	GSS-Chart	GSS-Plottsk	Harvard Presentation Graphics	KeyChart	Nimbus
List price	$395.00	$295.00	$495.00	$495.00	$295.00	$295.00	$395.00	$149.00	$195.00
AVAILABLE CHART AND GRAPH TYPES									
Bar	●	●	●	●	●	●	●	●	●
Stacked bar	●	●	●	●	●	●	●	●	●
Overlapped bar	●	○	●	●	○	○	●	●	●
3-D bar	○	●	○	●	○	○	●	○	●
Pie	●	●	●	●	●	●	●	●	●
Pie with removable slices	●	●	●	●	●	●	●	●	●
Line	●	●	●	●	●	●	●	●	●
Scatter	○	●	●	●	●	●	●	●	●
Area	●	○	●	●	●	●	●	●	●
High-low	○	●	○	●	●	●	●	○	●
Gantt	○	○	●	●	○	○	○	○	●
Organization	●	○	●	●	●	●	●	○	●
FEATURES									
No. of fill patterns	5	7	18	5	5	5	12	5	5
Chart legends	Auto	Auto	Auto, manual	Auto	Manual	Auto	Auto, manual	Auto	Auto
Chart labels	Auto, manual	Auto	Auto, manual	Auto	Auto, manual	Auto, manual	Auto, manual	Auto, manual	Auto
No. of axes for data	2	2	2	2	2	2	2	3	2
No. of axes that can be rotated	0	0	0	0	0	0	2	0	0
Manual axis controls	y	x,y	x,y	x,y	x,y	x,y	x,y	x,y	y
No. of images in standard image library	0	0	3	0	0	0	0	0	0
No. of fonts	1	21	5	Unlim.	7	7	5	6	18
No. of font sizes	Unlim.		5	Unlim.	7	7	Unlim.	9	Unlim.
Max. no. of charts per output page	2	1	Unlim.	4	4	1	4 (printer)	Unlim.	4
Paint program capabilities	○	○	●	●	○	○	1 (plotter)	○	○
Cut and paste to word processor	○	○	●	●II	○#	○#	●	○	○
Virtual page capability	○	○	○	●	●	●	○	●	●
Predefined formats	●	●	●	●	●	●	●	●	●
User-defined formats	●	●	●	●	●	●	●	●	●
Can use 8087 math coprocessor	○	○	○	●	○	○	○	○	○
COLOR AND RESOLUTION									
Max. no. of colors on-screen	16	4	16	4	16	16	16	16	16
No. of colors in on-screen palette	16	4	16	4	64	64	16	16	16
DATA IMPORT									
ASCII Comma delimited	○	○	○	○	○	○	●	○	○
ASCII in columns	●	○	●	○	●	●	●	●	●
.DIF	○	●	●	●	●	●	●	○	●
.SYLK	○	○	○	●	○	○	●	○	○
.WKS	●	●	●	●	●	●	●	●	●
.WK1	●	●	●	●	●	●	●	●	●
.DBF	○	○	○	●	○	○	●	○	○
Other files	None	None	.WR1, .WRK	None	None	None	.WRK, .PIC, .PFB/Graph	None	None
Reads files directly	●	●	●	●	●	●	●	●	●
Needs a utility to import files	○	○	○	○	○	○	○	○	○
Necessary utilities come with program	○	○	○	●	○	○	●	○	○
DATA INPUT DEVICES									
Mouse	●	●	●	●	●	●	●	●	●
Pad or tablet	○	○	○	○	○	○	○	○	○
DOCUMENTATION									
Disk tutorial	○	○	●	●	○	○	●	○	●
Paper tutorial	●	●	●	●	●	●	●	●	●
USER INTERFACE									
Help screens	●	●	●	●	●	●	●	●	●
Context-sensitive help	○	●	●	●	●	●	●	○	●
Command driven	○	○	○	○	○	○	○	○	○
Menu driven	●	●	●	●	●	●	●	●	●
Batch mode	●	●	●	●	●	●	●	●	●
FILE SIZE									
Test image file (bytes)	582	256	12,381	17,406	857	467	4,718	384	23,912
Total program size	564,051 bytes	243,000 bytes	1.85 Mbytes	2.29 Mbytes	534,373 bytes	344,642 bytes	359,554 bytes	295,138 bytes	1.35 Mbytes

■—Indicates Editor's Choice   ●=Yes   ○=No   †Not user definable.   IIWith Freelance.   #Unless the program supports the CGM metafile standard.

	Perspective	PFS:Graph	Picture Perfect	Slide Expert	SlideWrite Plus	**$500 AND ABOVE**							
						Energraphics	The Gallery Collection	GrafTalk	Graphic Decision Support System	Graphics Express	Impressionist	PCchart	Presenter/PC
Price	$295.00	$140.00	$295.00	$249.00	$345.00	$595.00	$695.00	$695.00	$795.00	$1,200.00	$995.00	$695.00	$995.00

	Perspective	PFS:Graph	Picture Perfect	Slide Expert	SlideWrite Plus	Energraphics	The Gallery Collection	GrafTalk	Graphic Dec. Support	Graphics Express	Impressionist	PCchart	Presenter/PC
	180	8	57	10	8	8	8	22	16	16	16	64	0
	Auto, manual	Auto, manual	Manual	Auto	Auto, manual	Manual	Auto, manual	Auto, manual	Auto, manual	Auto, manual	Auto, manual	Auto	Manual
	2	2	2	2	2	2	2	3	3	3	3	2	0
	3	3	0	0	0	3	3	3	3	3	2	3	0
	x,y	x,y	0	None	x,y	x,y	x,y	x,y	x,y	x,y	x,y	x,y	y
	1	1	7	72	101	99	600	0	0	0	0	0	2
	Unlim	1	13	3	12	8	15	24	6	6	6	1	2
	Unlim	4	Unlim	20	1	4	1	Unlim.	Unlim.	Unlim.	Unlim.	1	20

	Perspective	PFS:Graph	Picture Perfect	Slide Expert	SlideWrite Plus	Energraphics	Gallery	GrafTalk	GDSS	Graphics Express	Impressionist	PCchart	Presenter/PC
	2	2	8	4	8	8	8	16	8	16	16	16	16
	2	8	64	4	4	16	16	16	16	64	16	16	64

	Perspective	PFS:Graph	Picture Perfect	Slide Expert	SlideWrite Plus	Energraphics	Gallery	GrafTalk	GDSS	Graphics Express	Impressionist	PCchart	Presenter/PC
	None	PFS:Film	None	WRK, WR1	None	None	None	None	None	None	None	None	None

	Perspective	PFS:Graph	Picture Perfect	Slide Expert	SlideWrite Plus	Energraphics	Gallery	GrafTalk	GDSS	Graphics Express	Impressionist	PCchart	Presenter/PC
	512	1,536	1,354	1,024	1,174	1,774	1,069	1,683	8,660	8,538	8,000	2,560	2,571
	227,854 bytes	199,078 bytes	193 Mbytes	1.5 Mbytes	452,271 bytes	1.5 Mbytes	2.75 Mbytes	1,020 bytes	1 Mbyte	1.8 Mbytes	2.5 Mbytes	901,020 bytes	364,547 bytes

†† Only in drawing program.

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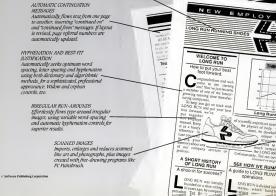
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Enable

Module for module, integrated programs generally offer fewer features than their standalone counterparts. *Enable*'s graphics module is a notable exception to this rule: despite some limitations, it has enough capability for most purposes. And, while the graphics alone don't justify the $695 price, The Software Group's *Enable* package as a whole could be worth it.

PERMISSION REQUESTED By any measure, *Enable* is easy to use. Installation is fully automated: the program asks a few questions about equipment then prompts you to put in disks as needed. Even better, the installation program announces what it's doing at each step. It even stops and asks permission when appropriate—a boon for sophisticated users who resent installation routines that mess around with their hard disks.

Enable's well-thought-out menus also help keep things simple. With few exceptions, the Lotus-like, one-word menu choices are constructed logically, making it easy for even a newcomer to get around. To change typefaces, for example, simply

choose Options, Global, and Fonts.

Speaking of Lotus, users of *1-2-3* who are dissatisfied with its graphics will find *Enable* particularly interesting. The *Enable* spreadsheet imports *1-2-3* files with no fuss to let you create graphs. *Enable* can also import *dBASE* files into its database module and create graphs from the database. Version 1.1 of *Enable*—the version tested for this review—is limited to *1-2-3*, Release 1A, and *dBASE II* files. However, Version 2 of *Enable*, which The Software Group provided in beta-test version (and which should be available by the time you read this), can also import files from *1-2-3*, Release 2, or *dBASE III*.

As part of an integrated package, *Enable*'s graphics module has several special

features. Although you can't display two graphs in the same window on-screen, you can use several windows to display as many as four graphs simultaneously. Also, while you cannot print more than one graph directly from the graphics module, you can copy multiple graphics to a word processing document to print several graphs on the same page (though not side by side). And, once the graphs are transferred to the word processing module, you can write text on top of them. *Enable*'s database management module lets you create graphics, too.

Among *Enable*'s niftier graphics features are its 3-D bar charts, both stacked and standard. Though confined to using the x and y axes, the bars themselves are

Enable offers some nifty graphics features, such as 3-D bar charts. It can output to printers, plotters (used here), and the Polaroid Palette image recorder. Unfortunately, Enable has some notable limitations. Pie charts, for instance, allow a maximum of ten letters for labeling each slide. This truncates "Manufacturing" to "Manufacturer" or "Real Estate" to "Real Estat." If you need perfect labels, you can, however, transfer the graphics to the word processing module and write text on top of them.

drawn in three dimensions. When you add a vertical and horizontal background grid, you have a much more interesting graph than the usual boring bar chart.

If you're interested in creating true 3-D graphs—using the x, y, and z axes—you should note that Version 2 of *Enable* will include *Perspective* (Three D Graphics, Pacific Palisades, California), a software package that generates true 3-D charts, as an integrated part of the graphics module. As with the standard graphics module, users will be able to graph databases and spreadsheets with *Perspective*. At the time of this writing, however, the Software

> With few exceptions, *Enable's* one-word menu choices are constructed logically, making it easy for even a newcomer to get around.

Group expected that *Perspective* graphics would not be transferable to word processing documents.

Unfortunately, *Enable* has some notable limitations. Pie charts, for instance, allow a maximum of ten letters for labeling each slice. This truncates "Manufacturing" to "Manufactur" or "Real Estate" to "Real Estat". The program also has a shortsighted approach to error recovery. In all of the tests for reading or writing a file with open disk drive doors, unformatted disks, and full disks, *Enable* caught the error and gave the option to retry or abort. If you choose retry, *Enable* does as it was told originally, and nothing is lost. But if you choose abort, *Enable* dumps you to DOS rather than taking you back to the program. That's not reasonable when you're trying to save a file to a full disk.

Enable's documentation, though good, has room for improvement. The package's spreadsheet and graphics manual provides

a good introduction to the program's capabilities, with most of the details explained, but I ran into at least one problem for which I could not find an explanation. Fortunately, The Software Group's well-trained technical support staff usually could give me an answer almost immediately.

It's misleading to focus on *Enable's* graphics module alone; the package targets mainly those who want graphics as one feature among many. Still, *Enable's* ability to graph files from *1-2-3*, *dBASE*, and elsewhere could make it an attractive supplementary program, particularly if you're loyal to one of these standalone programs but still need *Enable's* better graphics or its integrated structure. Though limited in some ways, the graphics far surpass those of most spreadsheets; with the addition of *Perspective* they will become better still. On almost every item, from ease of use to quality of documentation to vendor support, this package has a lot going for it.

—M. David Stone

Framework II

Reviewing an integrated program like Ashton-Tate's *Framework II* as a graphics package is a little like evaluating a BMW as a stereo system. It has the requisite features to get the testing started, but it cannot stand up against the professional competition. On the other hand, *Framework II* is worth considering as long as graphics are not your major need, in much the same way as a BMW can be a good stereo system if you simply want to listen to music as you get from here to there.

Framework II will create bar, line, and pie charts from data in a spreadsheet. You can put in a title, label the axes, and control the size of the graph. You can even specify the print attributes for the text of the graph. *Framework II's* installation program offers support for a wide range of printers, including the HP LaserJet. You can also specify a plotter; a few different ones can be used.

Data import is perhaps the strongest feature of the program. *Framework II* could import almost every format included in our test procedures. It imported the *.C-II* text file but could not put it in a spreadsheet. The *dBASE*, *.DIF*, and *1-2-3* work-

sheet formats went without a hitch. One of *Framework II's* slickest details was the way it automatically adjusted the individual column widths on the spreadsheet after the data had been imported, requiring a custom design that was as efficient as if I had designed it manually.

Despite that good news, *Framework II* will severely limit you once you start to design your graphs. For example, only one title line per graph is permitted. If you add no title, *Framework II* uses the frame label as the title. You can create a different title by either editing the frame label or modifying a formula associated with the frame. *Framework II* uses an unintuitive approach to set some specifications for the contents of frames; it puts hidden FRED formulas in the "borders" of the individual frames. (FRED is the *Framework II* programming language, similar to the Lotus macro language and the *dBASE* programming commands.) Graphs are defined through the @DrawGraph function, which accepts a seemingly endless string of parameters, one of which is the graph title. When you try to put a carriage return in the middle of

FACT FILE

Framework II,
Version 1.1
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502-1319
(213) 329-8000
List Price: $695

Requires: 384K RAM; two disk drives or hard disk; DOS 2.0 or later.

Supports: IBM Monochrome Adapter, CGA, and EGA; Hercules monochrome/graphics card; Hercules UltraPak; AST Monograph Plus card; Persyst Emulex BOB display adapter; STB Graphix Plus II board; Paradise display adapter; Sigma display adapter. Dot matrix, ink jet, and laser printers; plotters.

In Short: One of the best-known integrated packages, *Framework II* has only limited capabilities to produce graphs from spreadsheet data, sufficient only for incidental use in documents. If you want graphs from *Framework II* that can stand on their own, plan on buying a standalone graphics program. Not copy protected.

CIRCLE 683 ON READER SERVICE CARD

the formula, though, all you get is an error message. As a result, you're stuck with a single line for a title.

The @DrawGraph function was the source of a number of difficulties during our tests, especially when I tried to explode a pie segment. *Framework II* lets you explode one or all pie segments by using the last parameter. The manual shows that, unlike bar charts, which take up to nine parameters for this function, pie charts take up to ten parameters. When I tried to explode the segment, a syntax error occurred. So I then made the last parameter the ninth—only to be informed by the program that on pie charts, a maximum of seven parameters are accepted. With erroneous documentation and an obscure method of control, it's a wonder that *Framework II* users manage to explode their pies before their tempers explode.

PLOTTING PROBLEMS The draft-quality graphs produced by the IBM ProPrinter were quite rough, so I looked forward to seeing the plotted output. Luckily, I had noticed a few important details in the Install program. First, the Telecommunications module works only with a modem attached to COM1 (the first serial port). You can run a plotter off COM1, but then you may have to give up communications. To make matters worse, *Framework II* gives you no way to control the COM1 configuration; you are advised to use the DOS MODE command before you load *Framework II*—not a big deal but more technical than most users need to get for most programs.

When I plotted my graphs with the HP 7470A, the results were disappointing, to say the least. *Framework II* printed the title with such large letters that only the first two-thirds of the characters fit on the page.

The bars that were nicely shaded in the dot matrix printouts were simply left open on the plots; your only clue as to which bar was which was the color of its outline, and at first glance blue and black are not easily distinguished.

Framework II's pie charts were the downfall of the program's plotting performance. The plotter grabbed pens and shook for a while before putting them away and then lettering the text for the title and the legend. Again, the legend boxes were not shaded. I suspect that even if *Framework II* had plotted the pies, you wouldn't be able to distinguish among the different segments. In addition, *Framework II* gives you no way to label the segments directly. *Framework II* also had trouble printing boldface and underlined text.

To give the program a chance to print something of quality, I used an HP LaserJet Plus. Unfortunately, *Framework II* still knows about only the small-memory LaserJet, and it insisted that I did not have enough memory to print the graphs in 300-dot-per-inch mode. I had to settle for 150 dpi, which resulted in some clear and presentable charts even though the text was rather grainy.

Since *Framework II* uses frames to organize its elements, the program makes it easy to assemble multiple images for printing at one time. Unfortunately, you can print them only one after another in a vertical arrangement on the page, but I was able to fit four on a page with ease. Including a graph in the midst of a text report is just as easy to do. *Framework II* also has a very convenient feature that lets you link a graph directly to its spreadsheet, so that whenever you recalculate the data, the program redraws the graph.

Overall, the *Framework II* package gets low marks for its graphics program's flexibility and control features. The design quality of the graphs themselves is only fair, and the pie charts are difficult to decipher without labeled segments. If you're already using the integrated package for its other capabilities and are looking for a way to produce great graphs, plan on buying a standalone graphics package that will work well with the data *Framework II* puts out.—**Alfred Poor**

Javelin

Thanks to an innovative, flexible information-handling scheme, *Javelin*, from Javelin Software Corp., is perfect for anyone who needs to create a large number of graphs from a given set of data. Although the actual graphics capabilities are limited, they form part of a larger package that is well designed, well executed, and quite useful. At its original price of $695, *Javelin* gained a well-deserved reputation as a valuable business-analysis tool. At the new price of $199.95, it's that much more impressive.

Javelin's approach to handling information may well be unique. It lets you enter data in any of several formats, including a table of values, an algebraic formula, and a columnar worksheet (similar to a spreadsheet). Each of these formats is called a "view." Once you've entered and identified your data in one view, you can

manipulate and examine it easily in any other format.

For example, let's say you enter the equation, Profits = Income – Expenses, using the formula view. Then you use the worksheet view to create two columns, one for income and one for expenses, with each row labeled as a different year. Once you've filled in numbers for income and expenses, you can next go to the table view to see a table of income, a table of expenses, or a table of profits. Or, you can go back to the worksheet, add a new column for profits, and immediately see the numbers. You can even create a new worksheet, label a column as profits, and see profits for selected years.

Javelin also makes things easy when you create a graph. Once you've entered the data in the Javelin model, you need only select Define Graph from the one-line menu, and Javelin will present you with a graphics option screen. This simple, fill-in-the-blanks form lets you name up to seven variables and supplies labels for each on the graph. This screen also asks you to select your format: you can choose line, bar, stacked bar, percentage bar, horizontal bar, pie, and x-y plot. And it gives you blanks to fill in for title, subtitle, and labels for the x and y axes.

GRACEFUL RECOVERY On our tests for robustness, Javelin recovered reasonably well from errors to read or write a file

with open disk drive doors, unformatted disks, and full disks. In one case, Javelin informed me it was unable to load a file because of an "Unknown DOS Error 18" (the disk drive door was open). Most other messages were more informative than this, however, and in every case I needed only to hit Esc to recover. Recovery was simi-

> Using *Javelin* is exceedingly simple, thanks to a thoroughly thought-out program design. This thoroughness extends to the tutorials as well.

larly graceful when I ordered the program to print to an off-line or powered-down printer.
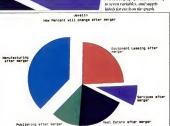
As this description suggests, using *Javelin* is exceedingly simple, thanks to a thoroughly thought-out program design. This thoroughness extends to the tutorials as well. The *Guide to Learning Javelin* explicitly recognizes that different people learn in different ways and offers two possible methods. If you like to work from examples in a book while using the actual program, *Javelin* supplies a hands-on written introduction. Alternatively, if you prefer using on-screen tutorials, *Javelin* gives you those, too. With the first approach, you can experiment while learning, with the second, you can't confuse yourself by making a mistake. I tried both sets of tutorials and found that each gave a good introduction.

Javelin's documentation seems to be well written and thorough, but I found one oversight. A Javelin Software Corp. representative said that the program could import comma-delimited ASCII files into a *Javelin* worksheet, with each comma-delimited number going into its own cell. I tested this feature and it works fine—but it's not mentioned in the import section of

Javelin offers a limited number of graph types, including line, bar, stacked bar, percentage bar, horizontal bar, pie, and x-y plot. Javelin outputs to printers and plotters (used here). But Javelin makes it easy to create a graph. Once you've entered your data, you make a single selection from a one-line menu to get into the graphics option screen. This simple, fill-in-the-blanks form lets you select graph formats, name up to seven variables, and supply labels for each on the graph.

Javelin
How Percent will change after merger

Manufacturing after merger
Equipment Leasing after merger
Services after merger
Publishing after merger
Real Estate after merger

the manual. I can't get too upset about extra features in a program, but if they aren't mentioned, they aren't much help.

Because its flexible data-handling scheme lets you pick and choose from information entered into your model, *Javelin* makes it relatively easy to create a number of graphs from one set of data. Its graphics section, however, offers nothing fancier than straightforward charts. If you're looking strictly for graphics, you can find programs that cost less and do more. But if you're looking for a business tool that uses graphics as one approach to analyzing data, *Javelin* may well be your program of choice. —**M. David Stone**

MathPlan

MathPlan, Version 3.0, is a new release into the spreadsheet/graphics market. WordPerfect Corp., originator of the well-known word processing program of the same name, is marketing *MathPlan* as a powerful spreadsheet designed to compete with Lotus's *1-2-3*, and it does that quite well. The product has obviously been carefully thought out and implemented, and it has the potential to become a major spreadsheet application.
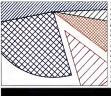
Yet as with *1-2-3* and other spreadsheet packages, it is extremely unlikely that anyone will buy *MathPlan* just for the built-in

graphics. However, considering that the main thrust of the product is its spreadsheet, the graphics functions are quite impressive.

Installing *MathPlan* is straightforward, even though six disks are required to support all the spreadsheet, printer driver, and graphing functions. An on-line tutorial has been designed to help you begin to use the spreadsheet part of the product; becoming familiar with the basic spreadsheet commands before using the graphics is probably a good idea. Surprisingly, though, it's not absolutely necessary. If you are familiar with *WordPerfect* and/or *1-2-3*, you should be comfortable with *MathPlan*, as it shares a fairly consistent command format with the word processor and just

enough of some similarities to *1-2-3* to be conventional. Also, some very good on-line help is available to help you out of most jams.

Creating and modifying a graph with *MathPlan* is an extremely simple task. With the spreadsheet data on-screen, you type Ctrl-F9 to define your graph type (1 = pie, 2 = bar, and so on). Then hit Alt-F9 to define the blocks of data you want to graph. When you finish, your graph is rapidly drawn.

Although the product is preset to define data in a specified row or column orientation, you can reverse that order when you specify the graph type. So it isn't necessary to rearrange your spreadsheet if it is in the wrong order for the graph type you

The pie chart below was output using the Polaroid Palette image recorder; MathPlan can also create output with printers and plotters. Creating and modifying a graph with MathPlan is easy. With the spreadsheet data on-screen, you type Ctrl-F9 to define your graph type, then hit Ctrl-F9 to define the blocks of data you want to graph. Your graph is rapidly drawn, then MathPlan displays a graph option menu at the bottom of the graph with numerous choices, such as moving elements or changing graph size.

have specified. This is convenient.

Once your graph is on-screen, *Math-Plan* displays a graph option menu at the bottom of the graph, with options for changing the graph aspects, moving elements, adding names from the worksheet to the x-axis, adding worksheet names for the legend, outputting to the specified device (printer or disk), and windowing to change the size. Within each of these menu options are numerous other choices, depending on the display used.

With an EGA display and card, you can specify up to 16 colors and different fonts and font heights, change fill patterns, ro-

> *MathPlan* supports GSS drivers and is unique in that it will run almost any screen driver, including those without graphics capabilities.

tate text, change the graph orientation, explode pie slices, and control many other aspects of appearance. The overall range of control is excellent, allowing when you consider that this is really not the main focus of the program.

You can change graph sizes in two ways. First, the window function lets you specify the size of the screen (or output) that the graph will occupy. You can draw a window easily by creating and stretching a box with the cursor keys. Second, you can move the displayed graphs to screen quadrants with the arrow keys or return them to full size by pressing Home. This procedure allows graphs to be saved in a smaller format that can be easily integrated into a word processing document—in *WordPerfect* format, of course.

A COUPLE OF QUIRKS While the graphics functions in *MathPlan* work quite well, a few minor quirks, most of which

can probably be ascribed to the fact that Version 3.0 is a brand-new major update, can be bothersome. For example, while you can change spreadsheet data and have it updated in the graph, you can't toggle back to the graph with a single keystroke. You need to press Alt-F9 again (for defining blocks), and then a few carriage returns, since *MathPlan* remembers the blocks you have previously defined. This method does give you the option of changing a block before redisplaying the graph, but it means you can't toggle back to the graph itself quite as easily as you can in some other programs.

Also, when you change the size of the graph by windowing, certain elements—pie slice names, for example—don't automatically adjust, and so you may have to move each one manually. You can get around this drawback by sizing the picture first and then adding the names, but again, it's less convenient.

Otherwise, *MathPlan* is a pleasure to work with. The file import/export facility is a breeze to use. It accommodates *1-2-3* files, .DIF, and *dBASE II/III* files, among others. Import/export of files is accomplished from within *MathPlan*, so you don't need to exit the program to handle the task.

MathPlan supports GSS drivers and is unique in that it will run almost any screen driver, including those without graphics capabilities (it will generate text-oriented graphics). The better your graphics system, the better *MathPlan* looks (and it looks just fine with either CGA or EGA combinations).

Besides the wide range of drivers included with the program, a wide range of other drivers are available from *WordPerfect* for a very nominal $5 handling charge. These drivers include those for such exotic display devices as the Bell & Howell Quintar series, the Intecolor 2427, and camera devices including the Calcomp, Magi Slide, and Polaroid Palette.

As with other WordPerfect products, the telephone support is exemplary. The call isn't free, but the help is, and support personnel are informed, patient, and courteous.

The graphics in *MathPlan* are fine for beginning and intermediate users, although they obviously lack some of the re-

finements of dedicated graphics packages. Without question, though, you can create some very attractive screens and output with *MathPlan*. When combined with the excellent spreadsheet component, *Math-Plan* is a superior software product.
—**Jon Pepper**

1-2-3

Graphs and *1-2-3* from Lotus Development Corp. were made to go hand in hand. The purpose of making a graph is to present your data in a visually appealing manner and to show your audience the subtle similarities, or the outstanding differences, among columns of numbers that might otherwise go unnoticed. You can easily fulfill these expressive desires using *1-2-3*, and the program lets you go from a worksheet to a graph in seconds. The level of sophistication is questionable, though: *1-2-3* limits you to just five types of graphs.

The most convenient aspect of creating graphs with *1-2-3* is that since you're most likely using data *1-2-3* created, you don't have to worry much about altering formats. And a separate utility is available to translate to and from *dBASE II/III*, .DIF, and *VisiCalc* files. Once translated, however, some files might need to be reordered to fit the *1-2-3* format.

1-2-3 builds graphs from the ground up.

The figures your chart will use are not entered as separate data points but rather as a range of data. As your data is already in a two-dimensional rows/column format, reading the ranges into the graph is a simple task. First, select the type of graph you prefer: line, bar, x-y, stacked bar, or pie.

The next step is to enter data. 1-2-3 recognizes up to six ranges for comparative data (except for bar charts, which can use only one range). As soon as you have entered the data, you may immediately display the graph. If you change any of the

Since 1-2-3 draws a graph, in conjunction with a spreadsheet, you can save the graph settings along with the companion spreadsheet.

numbers in the data ranges, the graph will reflect the change the next time it is viewed. The chart at this point shows only the information entered and a numerical scaling on the y axis.

The options menu allows you to complete the graph. You can use it to insert a main title and a subtitle across the top of the chart and to label both axes. Legends for all six data ranges can also be added at the bottom of the graph to identify the symbol, color, or cross-hatching assigned to each range. Other options include horizontal and vertical grid overlays, lines and/or symbols for line and x-y graphs, and y- and x-axis scaling. You can display your graph in color with a color monitor, or if you save your graph with color settings, it will be assigned colors when plotted. Press F10 or select View to display the chart at any stage of its development.
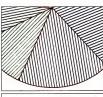
Since 1-2-3 draws a graph in conjunction with a spreadsheet, you can save the graph settings along with the companion spreadsheet. Simply by giving each chart a

different name, you can save more than one graph with each spreadsheet. You can then recall and alter each graph individually. If you intend to print the graph, you'll need to use a separate save command and put all the settings into a .PIC file.

You execute all graph printing and plotting from outside 1-2-3, entering the printgraph utility from DOS or through the 1-2-3 main menu. Printer and plotter setup occurs during the initial 1-2-3 installation; if you want to change the settings, you must go back and use the install utility again.

POINT-AND-SHOOT MENUS Familiar point-and-shoot menus guide you through the printgraph session. Select an
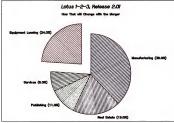
image or more than one (1-2-3 will print graphs sequentially), and choose the size that you want the output to be. Eleven font choices are available, but you can use only two in each graph. If you saved the .PIC file with color settings, you can select colors for each range, limited to the colors offered by your hardware. From then on, you issue the standard 1-2-3 print commands: Align and Go.

1-2-3 offers two types of tutorials, an on-disk version and a written one. The disk tutorial, "A View of 1-2-3," is not much more than a quick tour through the entire program; graphs get very little treatment. The easy-to-understand written tutorial, though, will help you build simple graphs. The reference manual is most helpful; it's

Lotus's 1-2-3 graphics are convenient to use. Since you're most likely using data 1-2-3 created, you don't have to worry much about altering formats. You can go from worksheet to graph in seconds. The level of sophistication is questionable though: 1-2-3 limits you to just five types of graphs. Lotus outputs to printers and plotters (used here). Since 1-2-3 draws a graph in conjunction with a spreadsheet, you can save the graph settings along with the spreadsheet.

Lotus 1-2-3, Release 2.01
How That will Change with the Merger

Equipment Leasing (24.0%)
Manufacturing (38.0%)
Real Estate (19.0%)
Publishing (11.0%)
Service (8.0%)

well written and easily understood, explaining all the graph and printgraph commands clearly and logically.

Depending on your hardware, the visual output from *1-2-3* can be quite impressive. What's more, the entire process is just very difficult. If you own a copy of *1-2-3*, give it a try. You may be able to get more-elaborate graphs from a standalone graphics package, but why buy something else when *1-2-3* will do?—**Christopher Barr**

SuperCalc4

SuperCalc4, from Computer Associates International, is an integrated spreadsheet program that allows you to assemble, analyze, and calculate numeric data. Its graphics capabilities, while not as extensive as those of some programs devoted solely to graphics, are more than adequate for most business needs.

SuperCalc4 has a gorgeous palette, with easy control for choosing graph component colors. Depending on your graphics adapter card and type of color monitor, you'll see 4 or 16 different colors on your monitor. With the fanciest configuration—an EGA monitor in high-resolution mode with an EGA adapter—you see the 16 colors but can change the red, green,

and blue values of each of the colors to customize your own palette.

All data for graphs in *SuperCalc4* is held in a *SuperCalc4* spreadsheet. You can either type that data into the spreadsheet or import it from other programs. *SuperCalc4* can input data files from *1-2-3* Release 1A and 2 (.WKS and .WK1), DIF, .SYLK, and ASCII text and comma-delimited files, as well as other formats. You don't have to leave *SuperCalc4* to import data files—a real convenience. And *SuperCalc4*'s data management function allows you to sort, select, or extract desired data items for display.

SuperCalc4 displays data in familiar spreadsheet columns and rows. You use the program's menus to choose up to ten
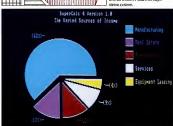
data groups for display, view different graph types, save the graph as a part of the spreadsheet file, and print it. If you want to change your data, all you have to do is to go back to the spreadsheet, make the change, and then immediately display the graph again.

Graphs are not saved independently of spreadsheets. Each sheet can have up to nine graphs associated with it. To call up a graph that you've already created, you load first the spreadsheet file and then the desired attached graph. If you need more nine graphs for a set of data, you can clone the spreadsheet: you copy the sheet, give it a new name, and then design another nine graphs.

Although *SuperCalc4* cannot produce

SuperCalc4 has a gorgeous palette, with easy control for choosing graph component colors. The package also has a good variety of chart and graph types for an integrated package, including bar, stacked bar, pie, pie with removable slices, line, scatter, area, and high-low. SuperCalc4 outputs to printers, plotters (used here), the Polaroid Palette image recorder and the VideoShow 160 presentation system. The package offers an impressive help system and an intuitive and thorough menu system.

SuperCalc 4 Version 1.0
The Varied Sources of Income

- Manufacturing
- Real Estate
- ■■■■
- Services
- Equipment Leasing

multiple charts on a screen, it can print multiple graphs on the same page of paper. To do so, you must specify page size, horizontal and vertical offsets, rotation, and the quadrant of the page in which you want the graph to appear.

AUTOMATIC AUTOMATION *SuperCalc4* also allows you to automate the whole process of creating graphs with its extensive macro language. To save time and ensure accuracy, you can build macros to recreate keystrokes for frequently used functions. *SuperCalc4*'s macro language also includes macros that create menus to customize applications. For example, you could automate graphics parameters to handle varying data sets. In addition, *SuperCalc4* goes a step further and automates the automation process with its macro "learn" feature that can watch your keystrokes and turn them into a macro.

An example of how convenient the macros can be is the process of preparing a monthly profit-and-loss report. If you store financial data each month in the same spreadsheet or a template of it, you could use a graphics macro to allocate data sets, set titles and labels, and customize the graph. Then you'd simply save, print, and display the new graph.

SuperCalc4's help system is impressive. From installation to help files to such on-the-go features as listing available files and graphs, *SuperCalc4* consistently provides information and offers techniques that save time and make the program's considerable power available to a reasonably adroit user. One example is the file listing routine, which displays a filename, comment, creation date, file size, and the name and type of all attached graphs.

SuperCalc4 installs itself. Whenever you run the program, it looks for video boards, 8087 chips, and the amount of memory available. The program then adapts itself to the system on which it's running. While you can also modify the program at any time to optimize for size of the spreadsheet or speed, you'll probably stick with the default settings most of the time.

An intuitive and thorough menu system leads you through the program's functions. *SuperCalc4* uses a horizontal menu structure with explanation and option lines below. As you issue commands, the program records the sequence of commands on the screen so that you can retrace your steps.

The *SuperCalc4* manual is all in one volume. which also includes two quick-reference cards (one for spreadsheet commands and functions and the other for graphics) and two keyboard templates. A short tutorial will get you up and running quickly. In addition, the manual includes a 144-page tutorial, of which 27 pages are devoted to graphics.

As an added feature, *SuperCalc4* includes Sideways, a utility program for printing in rotated, landscape mode. Also, *SuperCalc4* is relatively robust. Whenever I tried to fool the program—for example, by reading or writing from or to an unformatted disk—it gave me an error message, then came right back.

SuperCalc4 is a splendid graphics program that does much more. If you don't already have a spreadsheet program and need graphics, you may find all you need—and more—in *SuperCalc4*. A highly functional spreadsheet program that competes toe-to-toe with *1-2-3*, it produces attractive screen and printed graphics.—*Bruce Brown*

Symphony

Symphony, from Lotus Development Corp., is one of the best-known integrated programs around. With it, you can create graphs using the same program you use for spreadsheets, word processing, database management, and communications. Unfortunately, the graphics, while presentable, aren't astonishing, and they have a number of limitations. At a price of $695, *Symphony* is certainly worth considering for its capabilities as an integrated package, but not for its graphics alone.

The *Symphony* graphics module works almost exactly like *1-2-3*'s; you can quickly create bar, line, and pie charts from your spreadsheets or your database records. If you have two monitors, you can view the graph on one while editing the data on the other. The graph is not updated automatically when you change the data, however; you must redraw it to see the effects of any changes.

Though *Symphony*'s graphics module

doesn't burst with features, it offers a few options for improving your presentation. You can add titles, control the scale of the axes, specify the colors or hatching patterns used to fill elements of the graph, and choose the final size of the image on the paper. You can also select from 11 different type fonts for the lettering on the printout. For producing that hard copy, *Symphony* supports a wide range of output devices, including plotters and the HP LaserJet printers. If your printer is capable of graphics output, the chances are fairly good that *Symphony* will work with it.

THE PRINTGRAPH PROBLEM Unfortunately, the program also shares an important drawback of *1-2-3*'s graphics segment. Like the other Lotus package, *Symphony* creates and prints graphs using two entirely separate modules. This means that you must leave the worksheet-oriented *Symphony* module and enter the Print-Graph module every time you want to make a hard copy chart. Before exiting the spreadsheet portion, you must set up your graph, then save it as a .PIC file. After that you call up the image with PrintGraph, adjust size, fonts, colors, and other details, and print it on your printer or plotter. (You must have already installed the appropriate

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drivers with the separate Install module, but since this permits multiple drivers, you can load up all the drivers you might want so that you won't get caught short later on. You can also add new drivers with Install.)

One major implication of these separate functions is that you cannot print a graph as part of your spreadsheet or word processing document. Instead, each graph must be printed on a separate page—unless you want to leave space for it and then cut and paste by hand or feed the paper through the printer twice.

These drawbacks wouldn't be all that hard to live with if the graph quality were better. But Symphony imposes severe limitations on the amount of text and its placement on the graph. The fonts are accept-

able, but nothing to write home about (or with). Compared with dedicated graphing programs, this program has serious design restrictions: no second y-axis scale, no area graphs, only one graph to a page (although you can batch-print graphs), limited hatching patterns, and rigid placement of the graph elements.

Unfortunately, what features it does have are often difficult to use. To get shading or exploded segments on a pie chart, for example, you must set up a separate column of data on your spreadsheet to control these features. The graphics module's documentation is spread rather thin, making it tough to find what you want sometimes. To top it all off, Symphony is copy protected, although you can install it on a

hard disk so it'll load without a key disk.
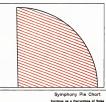
If you need an integrated package, you might consider Symphony. But if you're only looking for a way to get good-looking graphs, buy one of the standalone graphics packages.—**Alfred Poor**

Twin Classic
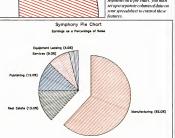
Users of 1-2-3 know about the drawbacks of its graphics module—you can create only five types of charts, for example, and you must use a separate utility program to print or plot. Twin Classic, a 1-2-3, Release 1A, clone from Mosaic Software, offers a number of improvements in this regard. This package has it all over 1-2-3 when it comes to building charts to be plotted later. Be aware, though, that its display drivers, and hence its screen output, fall far short of the Lotus program's.

The first noticeable difference between the two is the number of graph types available. With 1-2-3 you may build five different graphs. Twin Classic allows eight: line, x-y, horizontal bar (stacked or clustered), vertical bar (stacked or clustered), 3-D bar (clustered only), pie, 3-D pie, and pie-bar combination. To build the graphs, you enter your data directly from the worksheet, 1-2-3-style. Twin Classic lets you define up to eight data ranges, 1-2-3 only six. After assigning the data

Symphony offers a number of options for improving your presentation. You can add titles, specify the colors or hatching patterns, choose the final size of the image on the paper, and select from 11 different type fonts. Symphony supports plotters (used here) and the HP LaserJet printers as output devices. Unfortunately, the features it has are often difficult to use. To get shading or exploded segments on a pie chart, you must set up a separate column of data on your spreadsheet to control these features.

Symphony Pie Chart
Earnings as a Percentage of Sales

ranges, you handle most of the customization through the options menu, with a three-page pop-up screen acting as a blank input form.

Almost all of the graph options are entered manually. The first menu offering is a title of up to three lines, each of which can hold as many as 40 characters. After typing in each line, you specify size (choice of eight), colors (choice of eight, but limited to your output hardware), font (3 are available at any one time, although there are 11 fonts in total), and justification (left, center, or right). You can enter foot-

With *Twin Classic*, you print and plot through the graph sub-menu. This lets you change any of the elements of the file you are about to plot.

notes of up to three lines, which will be displayed at the bottom of the graph; here again, you can select size, color, font, and justification. If you make no selections, *Twin Classic* will default to a standard size and font, will format black color, and will center the titles and left-justify the footnotes.

The second page of the pop-up menu deals with the axes. *Twin Classic* will automatically assign values to both axes if you leave these spaces blank, but you can also add a second y axis, change the scale, and add a grid or frame to your chart. If you like, you can decide where tick marks should go and how many you want to display. You can choose between small and large labels and legends (the default is small).
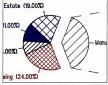
The last page of the customization menu lets you define the chart's attributes. These include colors and patterns. Eight of each are available, but the color selection matters only if you intend to plot the graph,

since only three colors can appear on-screen at one time. Bar charts can be exploded, and if you are building a pie-bar chart, you can select the data range, label range, and subtitles here.

With *Twin Classic*, you do your printing and plotting through the graph sub-menu, not through a *1-2-3*-style separate utility. The advantages are clear: you can quickly change any of the elements of the file you are about to plot. However, you are also limited to only three fonts at a time, and you can't move, rotate, or change the size of the graph on the page—all of which you can do with *1-2-3*. *Twin Classic's* hardware setup is completed ahead of time directly from the main menu.

SLOPPY SCREEN If this program works well in creating hard copy, it falters badly on-screen. The video display is quite sloppy and lacks sharpness. Don't expect an EGA monitor to solve the problem—*Twin Classic* won't take advantage of the improved screen, so your EGA output looks like a CGA picture.
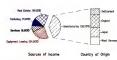
If you're looking for a *1-2-3* spreadsheet lookalike, you should probably at least consider *Twin Classic* for $99. Solely from a graphics standpoint, however, the package can do some things *1-2-3* can't, and vice versa. Though you might make some beautiful graphs, you'd better be ready to plot them, because this program's screen representation may disappoint you.—**Christopher Barr**

Twin Classic, a 1-2-3 clone, offers a few improvements over Lotus's package. The most noticeable is the number of graph types offered: Twin Classic has eight to 1-2-3's five. The package lets you specify titles of up to three lines, gives you a choice of eight chart sizes, eleven fonts and right, and center justification. You can also enter footnotes of up to three lines. The package outputs to printers and plotters (noted here)—you can plot up to eight colors. Unfortunately, you can only display three colors on-screen.

TWIN CLASSIC
How That Will Change With the Merger

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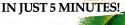
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HEWLETT PACKARD

dBChart

A utility program that converts dBASE II and dBASE III databases into graphs, Wordtech Systems' dBChart cannot run without a version of dBASE. So if you don't use dBASE, forget it. But if you are among the hundreds of thousands of dBASE users, you'll find this program quick to learn, easy to use, and fairly functional.

dBChart offers eight different graph types, including column, stacked column, deviation, line, step, pie, doughnut, and pictograph. The program's pictographs use symbols to represent quantities of items. dBChart comes with six standard pictograph symbols and lets you design and save your own symbols with simple cursor movement to turn blocks on or off in a simple 16 by 32 matrix. In all, you can create and save up to 26 symbols.

Installing dBChart doesn't take long, but it does involve a few requests that might put off novice users unfamiliar with DOS. You are asked to invoke the DOS GRAPHICS command either in your startup batch file or at least before running dBChart. For some dot matrix printers, even if it claims IBM graphics compatibility, dBChart requires that you send an Esc+"1" code to correct vertical spacing. These two requests should be simple enough for savvy dBASE users, but con-

fused beginners may need to seek help.
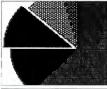
dBChart's screen output is limited to the Color/Graphics standard, which is very harsh if you're used to EGA-quality graphics. If you choose dBChart's "high-resolution" graphics, you get a yellowish color (mustard on my MultiSync) as a white background. The dBChart menu is always in "high-resolution" mode. The program can draw graphs in standard IBM CGA colors, however—either cyan, magenta, and white, or green, red, and yellow. Both color sets use a blue background. You can live with dBChart's screen resolution, but it seems rather crude when compared with that of many other graphics products on the market.

dBChart is also quite limited in printer

selection. The only form of hard copy available is that from either IBM or Epson graphics printers or compatibles. The program doesn't support plotters, laser printers, or any other devices. Printing, however, is very easy.

dBChart runs easily—using just seven function keys, F1 through F7. There's not much to the manual, but what's there is very clear.

USING dBCHART

When you use dBChart, you first go into dBASE and Use (a dBASE command) the file you want to convert to a graph. From within dBASE you run the dBChart conversion program (either GRAPH2 or GRAPH3, depending on the version of dBASE you're using)

dBChart's appeal is that it works directly with dBASE. It can do some fancy things like explode pie segments. But if you're looking for quality output, you might want to look elsewhere. The only form of hard copy output is from IBM or Epson graphics printers or compatibles. The program doesn't support plotters and will support laser printers only if you purchase Lasercontrol software from Insight Development Corp.

The Varied Sources of Income
f.1=Draw f.3=Previous f.5=Help f.6=Print f.7=Color

follow screen prompts to choose a sort field and a label display field. You also choose or skip other fields for inclusion in your chart. At this point you also enter a title and a footnote (used like a subtitle), each of which can be up to 60 characters long. When you finish answering the prompts, your converted file is saved with an .ASC extension. Your original .DBF file is not affected.

To create a chart, you next exit dBASE and issue the command dBChart filename.ASC. dBChart loads the converted dBASE file and lets you modify the presentation aspects of the data, depending on the graph type you choose. Modifying a graph is easy, using windows that present current settings of various parameters and give you the option of changing them. At this point, you can print the file or save it for further use.

Be careful when you run dBChart. Writing to an open disk drive yields an "Abort, Retry, Ignore?" message, and trying to save on an unformatted disk gives you a General Failure Error; unless you put in a formatted disk, you'll lose your work. Trying to print with no printer hooked up or with the printer in off-line condition will hang the program until you either turn off the printer or put it on-line.

dBChart's appeal is that it works directly with dBASE. But many other programs will read .DBF files or comma-delimited files (both of which dBASE can create, as well as ASCII print files), and you may find that some of these other programs offer better use of the screen, support for more hard copy devices, and fancier and more numerous graph styles. The other programs often can also use files from programs other than dBASE, as well as create their own data tables for graphs.

Even though dBChart's pictograph symbol function, with its ability to create custom symbols, is an attractive feature, it too is just an added property of a program that still remains a utility for dBASE. If you're not already a dBASE user, dBChart's appeal isn't strong enough to justify buying dBASE for the sole purpose of entering data into dBChart. In sum, dBChart is a single-purpose program—for dBASE users only—that would be a buy at $25 but is easy to exclude from your list at $99. **—Bruce Brown**

Giraph Business Graphics

When it comes to business graphics choices, it's a jungle out there, but there is a graphics package that stands head and heel above the others. Giraph Business Graphics, from CompuVision International, is an inexpensive graphics package that lets you create, modify, and plot a wide variety of graphs. Point-and-shoot menus guide you through the graph-building session, making the process easy. When the graph has been completed and you are satisfied with the screen version, you can send the output to a printer or plotter.

You can create many different charts with Giraph, including the basic scatter, step line, line, vertical bar, horizontal bar, pie, high-low-close, and text charts. Within these main categories, there are options, such as making vertical and horizontal bar charts regular, clustered, stacked, 3-D, or 3-D stacked, and also combining graphs, for example, combining a vertical bar chart with a line or high-low-close chart.
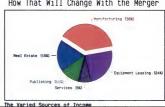
The first time you dive into the program, Giraph prompts you for setup parameters. You can specify the drive and path, units of measurement (inches or millimeters), and plotter. If you select a plotter, you can then pick the COM port, bits-per-second rate, and pen colors. The settings are saved and can be changed at any time.

Although it is inexpensive, Giraph Business Graphics lets you create more different chart types, including this exploded pie. You must insert all titles and labels manually, except for the axis, which can be inserted either manually or automatically. But Giraph has a floating-text option that gives you up to 18 lines of up to 40 characters each that you can place anywhere on the chart. The package outputs to printers and plotters only.

Data entry is handled in a smooth, orderly fashion. *Giraph* can read *1-2-3* .PRN files, .DIF, SYLK, and ASCII files and can receive data through the keyboard. It creates a data-input grid similar to a spreadsheet, with a 20-character label column on the left and data columns on the right. After you enter data, each row will be a data bar and each column, other than the label column, will be an observation or data point.

As soon as you enter data you can view the graph. The on-screen palette can be changed by pressing F9 and F10, but this has no effect on any output you might create. Then to edit the graph or the data, just press Esc to return to the action menu.

SELECTING TYPE SIZE All titles, labels, and legends are inserted manually, except for those on the *x*-axis, which can have either manually or automatically inserted date labels. Titles can be one, two, or three lines and can have up to 40 characters on a line. Once you input the title, you can choose one of five character sizes: tiny, small, medium, large, or huge. Choosing a character size is a bit difficult, however, because on-screen you do not see much difference among the sizes. The choice comes into play only when you produce hard copy, and then the only way to determine the exact size of each character

is to make the output and visually compare the results. You can also select colors for the titles, but only if you had previously entered the different colors available on your plotter. Titles can be left or right justified or centered.

Giraph has a floating-text option, whereby you can have up to 18 lines of up to 40 characters each that can be placed anywhere in a chart. It takes a little practice to place the text exactly where you want it. You can use any of eight character formats with all titles, labels, and text.

There are design menus that enable you to accessorize the graphs. You can choose from six hatching patterns with five densities, change a chart's axis height and width, add tick marks or grids, and move legends around. You can rotate a pie chart to different starting points, place values inside or out of the slices, and segment any or all of its slices.

Giraph has a batch option that is used to display or print up to 100 files. This feature is especially attractive if you want to send multiple files to a plotter or create a slide show to save and display again.

There's a tutorial in the manual, but the program is so easy to learn you probably won't work all the way through it. The manual itself is understandable and clear.

Sending your output to a printer or plotter, or, in fact, using any feature is simple with *Giraph*; just follow the menus. If you need a graph program to make standard types of charts and graphs, try *Giraph*. It's versatile, inexpensive, and easy.

—*Christopher Barr*

the number of other RAM-resident programs you install. (One big concern with RAM-resident programs is their compatibility with Borland International's *SideKick*. *Graph-in-the-Box* and *SideKick* work together just fine—when you load *SideKick* last.)
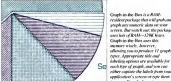
You install *Graph-in-the-Box* with the easy-to-use, menu-driven GBSETUP program. The GBKILL command is a nice feature that lets you uninstall *Graph-in-the-Box*, thereby freeing up RAM space. Some other RAM-resident programs aren't so polite.

EASY DATA CAPTURE Selecting data from the screen is simple. You use the cursor keys to move to the beginning of the desired block of data, press Enter to mark it, then move to the end of the block and press Enter again. You are limited to capturing data that can be shown on one screen, because while you're in the *Graph-in-the-Box* system mode, you can't move the screen on your original program. If the data you want extends off the screen, you have to save the first batch in *Graph-in-the-Box* and then go back to your application and get another screen's worth, and so on. You also use *Graph-in-the-Box*'s data facility to enter data, labels, and titles for your graphs.

Graph-in-the-Box

Graph-in-the-Box, from New England Software, is a RAM-resident graphics program that can grab and graph any data on your screen, including word processing, spreadsheet, and database files—even file sizes in your directory. For $97.60 in the copy-protected version (the non-copy-protected version is $50 more), *Graph-in-the-Box* may be just the ticket if you need to make graphs from a variety of data sources quickly and easily.

Beware: *Graph-in-the-Box* uses a good deal of RAM—a total of 129K bytes. To guarantee that there will be enough memory for your application, you'll have to limit

Graph-in-the-Box is a RAM-resident package that will grab and capture numeric data on your screen. But watch out: the package uses lots of RAM—129K bytes. Graph-in-the-Box uses this memory wisely, however, allowing you to produce 11 graph types. Appropriate title and labeling options are available for each type of graph, and you can either capture the labels from your application's screen or type them in yourself on the layout screen.

With the captured data, Graph-in-the-Box can produce 11 graph types, including column and bar, stacked column and bar, line, area, step, scatter, pie, and mixed charts. You can even display different data items in different ways within one graph; for example, you can display one data item as a line, the others as bars.

Appropriate title and labeling options are available for each type of graph. You can type titles and labels on the layout screen yourself or capture them from your application's screen.

The Graph-in-the-Box manual is very good but lacks an appendix listing the supported hardware. The manual includes a quick-reference page inside the front cover that defines the use of the function keys

and other control keys. The reference page also gives an eight-step minitutorial that presents a quick overview of how to use the program.

The copy-protected version of the package can be installed twice on a hard disk. New England Software will replace bad system disks at no charge for registered users. They will even send the new disk before they receive your original disk—a relatively painless, user-supportive approach to copy protection.

Graph-in-the-Box is best used as an extra program to grab data to create quick graphs. For that purpose it can't be beat. But its ease of use and value for the price also make it competitive with standalone graphics programs. —Bruce Brown

Micrograph

Micrograph, priced under $100 from Willy Verbestel, gives you the basics: bar, line, pie, and scatter graphs. A menu-driven program, it can be learned quickly, and it has some other fine qualities—it can produce two pie charts on the same page, for example, and can plot a trend line on a scatter diagram. Set against these advantages, however, are a legion of shortcomings. Even at so low a price, the program's usefulness is questionable.

The problems begin with the manual. Although it's punched for a standard IBM-style binder, you must supply your own: the pages come in a Ziplok baggie. The manual has a table of contents but no tutorial or index. In fact, of its fewer than 50 pages, many are simply representations of sample printouts. The reference material is loosely organized along the lines of the menu options, so you stand some chance of finding what you need when you get stuck. Given the size of the company, however, technical support could prove difficult to obtain.

Enter the program and things get even messier. Data entry is tricky, since you have to move the cursor through all the screen data fields each time. Occasionally, you may be asked to enter data for a series that you don't want to define; the program doesn't make it clear when this data will

FACT FILE

Micrograph by ZT's

Micrograph,
Version 2.0
Willy Verbestel Inc.
P.O. Box 4373
Burlingame, CA 94011
(415) 505-1145
List Price: $95
Requires: 128K RAM;
one disk drive; DOS 2.0 or later.
Supports: IBM CGA. Dot matrix and ink jet printers; plotters.
In Short: Although *Micrograph* is easy to learn, doesn't cost much, and can support a popular plotter, it's a minimal system supporting a minimum of output devices with a minimum of formatting options. Not copy protected.
CIRCLE 675 ON READER SERVICE CARD

Micrograph can be learned quickly, and it has some other fine qualities—but set against these advantages are a legion of shortcomings.

Micrograph, *though easy to learn and low cost, can produce some fancy outputs, such as two pie charts on the same page. However, the program has significant limitations. On the pie chart, for instance, you get only ten characters to label each segment; on the dual pie chart printout, you can't make separate headings for the two graphs. Also, the package supports only three output devices: Epson MX printers, the HP 7470A plotter, and the Radio Shack CGP-115, a device that draws using little ballpoint pens.*

take and when it will be ignored. Moreover, on our tests for robustness, *Micrograph* showed uneven error-trapping. It would sometimes dump you to DOS when you least expected it.

Still more unsettling, *Micrograph* creates a new "layout" (graph definition) every time you modify an existing one. The new layout has the same title as the original (unless you change it on purpose), so you can end up with a list of identical names without knowing which is the one you want. There's also no way to delete an individual layout—all are stored in the same DOS file for a single session. To clean house, you have to open a new file and copy the layouts you want from the other file.

This program won't give you the most attractive output, either. The only font available for headings is a fairly angular sans-serif typeface. You can set up headings for the *x* and *y* axes and label the units for the *y* axis, but you can use only a few characters for each. On a pie chart, you get only ten characters to label each segment; on the dual pie chart printout, you can't make separate headings for the two graphs.

THREE DRIVERS *Micrograph*'s limitations do not stop there. It supports a grand total of three output devices: Epson MX printers, the HP 7470A plotter, and the Radio Shack CGP-115 (an inexpensive device that draws using little ballpoint pens). The program wouldn't work with our IBM Graphics Printer used in this project, so we had to use the HP 7470A plotter. The results were fairly good, with a few puzzling exceptions. For example, you can print overlapping bars to give a simulated 3-D effect. Unfortunately, though, the plotter actually overlaps the bar plots, and the mixed colors that result are not always attractive. Also, if you're using different pen colors on the dual pie chart, you have to make endless pen changes because the program plots one chart completely before it starts the other.

The program's publisher makes a point of its data-import capabilities: DIF, *SuperCalc*, and *dBASE*. Once you get into the manual, however, you'll find that this, too, has a catch. The .DIF files must be carefully formatted with arcane "flags" set in the leftmost column and across the top. *SuperCalc* works the same way, except that you turn the worksheet into a print file before bringing it into *Micrograph*. Only the *dBASE* import worked with our test files—and then only for bar charts (though the program wouldn't let us specify years as headings for them). The data for the pie charts from our *dBASE* import was incorrectly organized.

If you need a low-end program, you like the way that *Micrograph* formats its graphs, you can put up with its limitations, and you happen to have a printer or plotter that it can talk to, then it might be worth risking $100 on this one. Otherwise, you would do well to look elsewhere.

—**Alfred Poor**

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How does Lotus HAL do all this—for all users?

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Lotus HAL makes executing 1-2-3 procedures even easier than before. Because it accepts phrases like ''total sales,'' ''graph Jan to Mar,'' or ''copy this to A10,'' etc. In fact, Lotus HAL's vocabulary includes English words and phrases. So you can customize a command dictionary of your own—with the words and operations you're most used to and most comfortable using.

Since Lotus HAL makes 1-2-3 more accessible for all users, you'll learn more—in less time—about all the capabilities of 1-2-3.

For instance, if you're presently using only the spreadsheet, Lotus HAL will show you how to create graphs and do database functions—far more simply than ever before.

Time-Saving Shortcuts, Easy-To-Create Macros

With Lotus HAL, you'll take shortcuts and accomplish multi-step tasks quickly and easily. So you'll greatly reduce errors—and save time.

And, with a simple ''undo'' command, Lotus HAL even lets you recover from errors you've already made. So if you're a novice user, you'll learn faster and with greater confidence. And if you're an experienced user, you can experiment more freely and do ''what ifs''—without fear of having a mistake destroy hours of work.

Lotus HAL also makes developing macros simpler than ever—so simple, in fact, that even novice users can create 1-2-3 macros with Lotus HAL. And no matter how familiar with 1-2-3 you are, you'll benefit from being able to write and test macros to make sure they do what you had in mind.

New Power

Lotus HAL will let you take 1-2-3 as far as you need. And if you've been taking it far already, Lotus HAL offers you new commands that will further enhance your productivity.

For example, Lotus HAL lets you replace items anywhere in the worksheet (even within formulas), and create a dynamic link between cells in multiple worksheets. It also lets you audit your worksheet—so you can find mistakes without having to review the entire sheet ''manually.''

Best of all, while Lotus HAL greatly enhances 1-2-3's commands, it doesn't change either 1-2-3 or the worksheet. It's always available, but it never gets in your way. And you can share data as freely when you're using Lotus HAL as you did when you were using 1-2-3 alone.

In fact, you can do everything you've ever done with 1-2-3 even better... plus a great deal more.

And since Lotus HAL is part of the 1-2-3 system—and the Lotus family—you get an unparalleled commitment to customer service and support that will keep you up and running.

The Benchmark Graphics

The Benchmark Graphics program is one of The Benchmark series of applications programs from Benchmark Software/Metasoft Corp. Besides the graphics program, the series includes a word processor, data manager, spelling checker, mailing list, form builder, message pad, notepad, three-dimensional spreadsheet, and telecommunications. Also part of the series is an operating program called The Administrator, which controls the installation, configuration, and operation of all the modules. *The Benchmark Graphics* is powerful, with many features, but the current version is fairly difficult to use.

The program has five levels and types of commands: primitive, system, business graphics, output, and user-defined. You can choose the command options from the three-letter, horizontal menus or issue the commands directly from the keyboard. The program's user prompts are too sparse, which, coupled with the number of commands and features, makes its power somewhat inaccessible.

The separation of each feature is responsible for the primary difficulty in using the program. If you want to change from using a printer to using a plotter, for example, you have to go to The Administrator to reconfigure, restart the system to set the parameters, and then start to plot; you can't have both a printer and plotter ready to go at the same time. When you create a graph, you work on data (in a spreadsheetlike table) separately from other graph parameters. I found myself having to move around to different parts of the program more often than seemed reasonable.

DOING WHAT YOU WANT *The Benchmark Graphics'* considerable power consists in allowing you to do almost whatever you want with your screen. You can create and store geometric or freehand line images, call up fill patterns and colors, and enter text wherever you like. The font builder lets you create your own custom fonts. By creating, naming, and saving images, you can use a slide show–like replay capability, including pauses to create animation on the screen. The labor involved is undeniably significant, but the possibility is there because of the program's rich list of features.

The Benchmark series comes with the Benchmark Tutor Training System, which includes a separate book for each of the program's major modules. The book for *The Benchmark Graphics* includes four lessons on creating and using graphics and

The Benchmark Graphics *outputs to printers and plotters only, and so the image below was created using a plotter. The package offers quite a few features, including the ability to place text wherever you please. However, the labor involved in using these features is significant; the program's user prompts are sparse and the number of commands that you must learn are numerous.*

BENCHMARK

THE VARIED SOURCES OF INCOME

Real Estate 3.0%
12.0% Publishing
9.0% Services
4.0% Equipment Leasing
Manufacturing 62.0%

two lessons that cover integrating graphs with word processing documents and using the custom font builder. The tutorial provides step-by-step keystroke instructions, but it has very few illustrations and no photographs.

The *Benchmark Graphics* manual describes all the program's features, but it uses tiny type on colored pages, coded by application, and is a bit hard to read. Each section of the manual has its own index, but I found it difficult to find information to tie the sections together.

There is no way to quickly find answers to many questions in the manual. When I called Metasoft for help with creating and printing graphs, however, I found the technical-support staff to be helpful and very courteous.

The program could use better error-trapping capabilities. However, the one problem with disk access that it does cope with successfully is being told to write to a full disk. The *Benchmark Graphics* responds with the message that there is insufficient disk space and then comes back to the program immediately.

The *Benchmark Graphics* is best suited for someone who wants to create highly customized graphics. It has terrific potential because of the combination of drawing, painting, font creation, free-form text entry, and image-naming capabilities. Yet the current program is awkward to use and involves a lot of effort—not a good choice for the casual or beginning user. So until the program's The Administrator is easier to learn and use and its manual and user interface are improved, its true potential will probably go unrealized except by the most adventuresome.—*Bruce Brown*

Boardroom Graphics

According to many software manufacturers and users, a large number of business users like their software cheap, easy, and quick. Analytical Software's *Boardroom Graphics* is a basic, no-frills package for just these people.

You'll get an idea of the product's general orientation the minute you open the manual or call up the opening menu. *Boardroom's* default configuration is set for a single drive; the program starts with an AUTOEXEC.BAT file, and the manual neglects to give instructions for hard-disk installation until you have reached the instructions for calling up the package. At any rate, even if you're knowledgeable enough to immediately copy the program over to your hard-disk subdirectory, you'd better have that floppy disk in the A: drive; *Boardroom Graphics* is copy protected

> Analytical Software's *Boardroom Graphics* is a basic, no-frills package for business users who like their software cheap, easy, and quick.

with a key disk.

The opening menu gives you the choice of changing your present configuration, starting a new graph, or choosing a previously created one. It also allows you to choose your default drive; unfortunately, the program does not save the drive configuration and will always pop back to a default of A:.

GETTING DOWN TO CASES
Boardroom Graphics operates in what it calls "cases," which are groupings of nine graphs (this setup permits the program to show the nine graphs in "slide show" format). Each case is appropriately labeled with a five-character appellation. It's easy enough to move from chart to chart within a case—you simply must go back to the menu and call up a different chart. The catch is that once you have chosen your case, you are stuck with it for that session; the only way to change to a different case is to restart the program.

Before inputting any data, you first determine the structure of your graph using a very simple, one-screen menu format. It is here that you decide upon such items as titles, legends, and axis criteria. The program offers a nice range of graph types, including both two- and three-dimensional bar charts, pie charts, line charts, and scatter plots. However, while the program can merge two charts on one page, it will not merge bar charts.

The number of items that can be plotted on one graph is determined by the type of graph you choose. For example, most graphs are restricted to three items per graph, unless you are creating an unshaded line graph, a pie chart, or a bar chart for use with a six-pen plotter; in these cases, you can graph up to five items. Each item is limited to a 10-character label; axis labels are limited to 16 characters. There are few, if any, bells and whistles here, except for a "texting" element that allows you to add extra text directly to a previously plotted hard copy chart.

Once you have set up your chart, you can input your data. While *Boardroom Graphics* has a facility for accepting *1-2-3* .DIF files, you must first set up the files in *1-2-3* in a manner that fits the program's format. I found it easier to simply input the test data directly.

Once the chart is complete, what gets printed is not what you see on-screen. For example, in my test bar chart, years were written out in the plotted graphs (i.e., 1981), but only the last two digits (81) showed on-screen; the vertical legend was printed sideways, but on-screen it appeared vertically, one letter below the

Boardroom Graphics offers a nice range of graph types but with some restrictions. For instance, while the program can merge two pie charts on one page (shown here), it will not merge bar charts. Also, a pie chart plotted with a six-pen plotter can show up to only five items. The program outputs to printers, plotters, and the Polaroid Palette image recorder. The pie chart below was plotted.

HOW THAT
WILL CHANGE

BOARDROOM GRAPHICS
SOURCES OF INCOME

Income

Income

Created Using BOARDROOM GRAPHICS

next. The plotted vertical axis increased in increments of 8, but on-screen it increased in increments of 10; grid lines were unbroken on paper, broken on-screen. Many of these differences are due to *Boardroom Graphics,* Version 3.0's rather primitive on-screen graphics capabilities. Version 4.0, which is expected to be available by the time this review appears, should take better advantage of your EGA board.

All in all, *Boardroom Graphics* is a basic business graphics program that produces good, basic charts for a reasonable price. Smaller operations with an occasional need for an illustrative pie chart could find it a handy addition to their software libraries, but larger companies who

want to produce more sophisticated or varied graphics will have to look elsewhere.—**Barbara Krasnoff**

Chart-Master

Ashton-Tate's *Chart-Master* is a dependable old-timer in PC graphics, but like a vintage wine, it's gotten better with age. Its turf includes bar, column, line, scatter, area, and pie charts. Mixed charts, charts with two axes, and multiple charts on the same page are all accommodated. The novice can create excellent charts with very little effort, while the advanced user can scroll through nine screen pages of options to add some artistic control (though

not as much as some might prefer). Other programs give more bang for the buck, but generally *Chart-Master* is an effective tool.

A *Chart-Master* session begins with a main menu of nine items, each of which carries a selection of fill-in-the-prompt submenus. You can select commands with the cursor keys or, more quickly, by typing in the corresponding command number. Select Create a Chart, and the program methodically leads you through a series of input screens, from chart title through data. All title and data entries are independent of the chart format, so you can graph the same data in different ways.

As you enter chart text information on the upper portion of your screen, the lower portion displays six options that let you select any of eight fonts, 16 sizes, italics, justification, color, and underlining. Although you cannot manipulate the font characteristics, all of them—standard, roman, and Swiss—have a boldface and/or italic counterpart. In addition, there is a script font and a useful symbol font that assigns frequently used business icons to the keyboard. These icons can't be altered with fills or freehand embellishments.

One of Chart-Master's most powerful features is its options menu. The options menu gives you access to an extensive symbol library, and a floating-legend option lets you add text after you've formed the graphics template. Chart-Master outputs to a variety of devices, including printers, plotters, and several image recorders, such as the HP 7510 with which the image below was created.

CHART-MASTER 6.2 GRAPHIC #4
How Will That Change With the Merger

TOTAL INCOME

STAT CLASS Unlike some packages that give you a visual row/column input format, Chart-Master operates in a nonvisual (and sometimes confusing) text environment. Moreover, Chart-Master's terminology is a bit too reminiscent of Statistics 101 for me. The program identifies chart components in terms of "variables" and "observations." I'm ashamed to admit that, though I intended to have five slices in my pie, I wound up with five separate pies instead because I couldn't tell my variables from my observations. If you paid attention in stat class, you'll fare much better.

Once you can identify variables and observations, entering data manually is

straightforward. Moreover, the new and much-improved Datagrabber facility, which imports files from other programs, is quite manageable. It can read .DIF, .SYLK, and ASCII files and can graph all or part of the imported files as you highlight the blocks in question. Unfortunately, editing a data chart is not as pleasant as creating one. Without seeing your data, you must choose to modify either a single entry or all data for a single variable or observation. There is no option to deal with a range of data.

Chart-Master does not allow you to store your charts in a directory separate from the program's. Even when you've just saved a chart, prompts informing you

that it will be erased still come up to haunt you. But by far the most annoying omission is the lack of a pop-up directory when you want to retrieve and save charts. If you don't know a file's name, you must trudge back to the main menu to see the list and then return. Also, the display screen should definitely contain the name of the current chart. It doesn't.

One of the program's most powerful aspects is its options menu, which lets you alter various elements of your chart such as hatching, grids, axis scalings, linetype, and location of the elements. With a new floating-legend option, you can add text after you've formed the graphics template. The nine pages of options are a mixed bag: some are toggles, some bring up their own menus, some request user input. In the end, I found the process quite manageable, but after wading through so many options, I expected better results. While the options are certainly comprehensive, a package that specializes in charts could use some whiz-bang enhancements such as 3-D, fill patterns for symbols, and some freehand capability.

Chart-Master's hardware support just gets better and better. The program can automatically detect the presence of an Enhanced Color Display. You can print your chart on-screen in either high resolution or with one of two color palettes in medium resolution; the program handles either one quickly and efficiently. It can plot multiple charts using a batch file command, and it also supports a whopping 80 device drivers. The manual is thoughtful, attractive, and detailed, and customer support is more than accommodating.

On all of our tests for robustness, Chart-Master performed well. The program is copy protected, however, and I couldn't install it on an AT clone. Still, perhaps Decision Resources, now owned by Ashton-Tate, will follow other companies' example and eliminate copy protection.

Chart-Master has survived many shakeouts, with each release emerging stronger than its predecessor. While the program requires more visualization from its users than some of the row/column chart makers on the market, those who use it well can truly become masters of their charts.—Robin Raskin

Decision Graphics

Here's a product that will make you glad you spent the extra money for an EGA monitor and graphics card, because *Decision Graphics* gives you beautiful screen output. Samna Corp.'s *Decision Graphics* is a well-organized program that combines menus and macro commands to give you a choice of ways to use the program; it also lets you customize data, text, and whole graph screens. At $450, *Decision Graphics* has to deliver a lot, and it does.

The program nearly installs and configures itself; you just sit back and let the software take over. Which is a good thing, since *Decision Graphics* has a lot of program files: if your PC, XT, or compatible has only one floppy disk drive, you're out of luck. *Decision Graphics* will run on a floppy disk system, but only if you have a 1.2-megabyte disk drive, the type common to most ATs and AT compatibles. Since the program has a lot of modules that are used only when needed, its developers obviously decided that swapping the

smaller, 360K-byte floppy disks would be inconvenient. With a hard drive system, though, it's okay to have only a 360K floppy disk drive because that drive is just used to load the software on the hard disk drive when you install the program.

Samna *Decision Graphics* uses both menus and a command language, easing your way into the program with the helpful prompts of menus and then letting you take over with the speedier commands once the functions and operations become easier to use. The program has many features, so it can't claim to be very easy, but Samna has done a lot to help. You can use either the menus or the commands at any time—a helpful way for beginners to gradually break into using commands and for experts to get help with seldom-used features.

When you're creating a graph, the Main Menu screen is divided into three vertical areas: menus on the left, data memory in the middle, and macro memory on the right. A command line extends across the bottom of the screen. This screen acts as the manager for the whole graph-making process. Whenever you are engaged in a specific step, such as choosing colors, writing screen text, or importing data, you leave the Main Menu and go to screens that handle the specific function, returning to the Main Menu screen when you've completed the task.

I like the way *Decision Graphics* imports data from other programs. Entering data from the keyboard is simple with this program, and importing files from other programs is equally easy; you follow some very clear questions on the screen (a printout of the data is helpful when answering these queries). You can import *1-2-3* .WKS and .WK1, *Symphony* .WRK and .WR1, .SYLK, .DIF, and ASCII print files.

The program gives you a great deal of control of visual presentation of data. You can combine up to ten different graph types in one graph, using all but pie graph, charts, or pyramid types in combined graphs. Graphs can be presented in two or three dimensions, and a zoom feature isolates individual data sets or times.

VARIOUS MENU TYPES *Decision*
Graphics allows you to use three different types of windows: standard windows for

one-quarter, one-half, or whole-size graphs, variable-sized windows, or legend windows. You can overlap as many windows as you want, the number limited only by the resolution of the display or printing device.

In addition, you can perform calculations on data items. *Decision Graphics* lets

> Samna's *Decision Graphics* nearly installs and configures itself; you just sit back and let the software take over.

you use prerecorded functions, or you can create your own formulas and functions using standard operators. The prerecorded functions include several statistical and scientific operations. You can also use regressions to plot trends of graph data.

Decision Graphics makes extensive use of macro commands. The program's existing macro commands, which can be used to run the program, consist of an apostrophe and four or five letters. The macro 'ERDA, for example, tells the program to erase data. In addition to using the built-in macros, you might want to use the macro language on the screen's command line to combine macros or create macros that define data, text, or whole-screen images. Once you get up to speed with *Decision Graphics*' macros, you can save a great deal of time and automate much of your work, especially if you use repetitive graph, text, or data settings.

Decision Graphics' slide-show capability combines screen macros with the 'WAIT command to display graphs continuously on the screen. You can make the graphs pause for a specified number of seconds ('WAIT10 for a 10-second pause) or assign a long time delay and then hit the Spacebar to bring up the next slide when

With Decision Graphics, you can combine up to ten graphs on one page, and with the exception of pie charts you can mix chart types. Graphs can be presented in two or three dimensions. But when you create a 3-D pie chart, you get a 3-D legend as well. The package can output to printers, plotters, and image recorders, including the HP 7510A, on which the pie chart below was created.

you're ready. The delay allows enough time for discussion between graphs.

Decision Graphics includes ten symbols that can be incorporated into charts. These symbols include a man, a woman, the Statue of Liberty, a tree, a house, the Eiffel Tower, and arrows that point up, down, right, and left. Samna Corp. will also create custom symbols for a fee. The program has no facility for building your own symbols, which limits the usefulness of this feature.

The program is flexible: you can open legend windows wherever you like on the screen, and you can write text anywhere you want. *Decision Graphics* lacks a default method of titling, though. To title

your graphs, you have to go through the Write menu and type the titles directly on the screen image of the graph. Beginning users will probably find this aspect of creating graphs the toughest part.

When you do create titles, you'll find that they don't print very well with a plotter. The technical-support people at Samna said that the proportional font was the best to use with a plotter; it worked but still wasn't very good.

This program is terrific at error-trapping, fielding every dirty trick I tried. Samna has protected users against the most common errors that often send programs into computer limbo, along with data and graph settings.

The helpful, well-organized documentation includes a 45-page tutorial. The manual offers a Menu Roadmap and a quick reference to all the menus, including a list of all program macro commands. I was particularly impressed with the complete instructions for installing printers and plotters, a relief after using many program that leave hard copy output device installation to default settings that list, but may not properly work with, specified printers. Also, when I called Samna's technical-support people with questions about creating titles and subtitles, I found them to be both knowledgeable and helpful.

Decision Graphics has a terrific user interface and offers many impressive features. The ability to create your own data, text, or whole-screen macros lets you significantly speed up the graphing process. The one drawback is the program's lack of default placement for graph titles, but it gives you complete flexibility for custom placement of text. *Decision Graphics* is a lot of program, greatly increasing your ability to create visual representations of numeric data.—**Bruce Brown**

Freelance Plus

Lotus Development Corp. has released a major upgrade to its graphics program, *Freelance*, adding a built-in graphing module and the ability to draw in freehand style. It's *Freelance Plus*, a program for people who want control over every detail of their images and who want to output to a wide range of devices. At $495, *Freelance Plus* is more expensive than some of its competitors, but it turns a standard IBM PC into a comprehensive graphics tool that rivals the capabilities of expensive turnkey graphics workstations.

The new graphing facilities allow you to create most common business chart formats, including vertical or horizontal bar charts and line, pie, and scatter charts. *Freelance Plus* enables you to ·enhance charts with free-form images that are created using all the tools common to a traditional graphics artist.

You can easily draw lines, boxes, and arrows and add text to an image. The program includes a predefined library of more than 500 common symbols, including maps of each of the 50 states. Optional

PLAY WITH YOUR DATA.

When we created R:BASE® System V, the whole idea was to make the full power of a sophisticated relational database available to people who don't feel like programming. Thanks to your enthusiasm, it's been quite a success. With our Express System, R:BASE System V offers you a combination of speed, power, and flexibility that's literally not available with any other DBMS. And now, we're introducing a new presentation graphics package that gives you the opportunity to play with your numbers and ideas in graph form.

But first, let's take a look at R:BASE System V, the product which makes R:BASE Graphics a powerful tool for understanding.

DATA MANAGEMENT RESULTS IN HOURS — NOT MONTHS.

With R:BASE System V, no matter how sophisticated the application, you just follow a simple, fill-in-the-blanks format, and our Application EXPRESS writes all the code automatically.

As a result, even as a first-time user, you can build a powerful, automated application. With the features you'd expect in a custom program from a professional programmer.

When you're done, you'll have automated the process of understanding your data. And be able to use it to make better decisions. With other database products, building an application like that could take months. But for a fairly typical application, with R:BASE System V, it's a matter of hours. For example, let's take a look at a company called ACME Novelties and follow them through a sales analysis.

To update a report like this takes just a few keystrokes, even though it contains computed columns, subtotals, and multiple-table access. And this is just the beginning: with new R:BASE Graphics, there are literally thousands of ways to play with these numbers.

With our Express System, it's easy to build an automated application without programming. From this point on, any of these functions can be performed by a simple menu pick.

INTRODUCING R:BASE GRAPHICS. TURN RAW DATA INTO PURE UNDERSTANDING.

Of the 100-plus graphics products on the market, this is the only one that works directly with R:BASE System V or R:BASE 5000/4000 data. And the only one that combines presentation-level graphics with powerful data reduction capabilities. With just a few keystrokes, R:BASE Graphics can sort through megabytes of data, retrieve just the data you're interested in, compare items any way you like, and put them into presentation-quality chart or graph form.

You won't even have to interrupt your train of thought. With R:BASE Graphics, you keep right on using the same familiar interface. You enjoy a totally integrated solution that turns raw data into pure understanding. And now you can express it graphically.
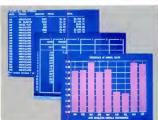
Let's take a look at the example here and see how the process works. The first screen you see is raw, un-

sorted R:BASE data. (This is the same data R:BASE System V would use to give you the ACME Novelties weekly sales report.) All you do is tell R:BASE Graphics what you want, and how you want it. It goes into the database, performs the sorting requests, and creates a graphable subset of the database. If you want a column graph that compares total product sales by month, all it takes is a few keystrokes, and you've got it.

Of course, this is only one example; with R:BASE Graphics, using a database to reach new levels of understanding is limited only by the imagination.

R:BASE Graphics gives you eight standard chart or graph formats, plus seven text fonts, 16 colors, and up to 32 windows of split-screen displays. R:BASE System V SuperMath functions have also been included for precise data handling. In all, there are over 40 mathematical, trigonometric, logical and financial operations. Of course, R:BASE Graphics supports most popular video control cards, plotters, and printers.

As you've already seen, by using R:BASE Graphics, ACME Novelties graphically identified their problem area: The Eastern Region. Now we'd like to show you another product that lets ACME review their data in a completely different way. R:BASE CLOUT.[*]

R:BASE CLOUT. THE DATA RETRIEVAL SOFTWARE THAT SPEAKS YOUR LANGUAGE. ENGLISH.

This artificial intelligence, natural language query software gives you another option. You just type your requests in plain English. CLOUT figures out exactly how to get the answers by translating common questions into computer commands.

CLOUT's natural language dictionary contains 300 commonly used words, and you can add 500 more (with definitions) per database. By adding unique definitions, you can customize CLOUT to your specific needs. Now let's go back to our example for a minute:

From R:BASE Graphics, we saw the problem at ACME Novelties was weak sales in the Eastern Region. Now the question is—who's responsible? Suppose we had taught CLOUT that the name for distributors was "bigshots."

▲ By breaking down your sales into percentage by month, and reviewing the data graphically, it's clear that something went seriously wrong in June and July, but as yet, nobody knows where.

Even though the data for quotas and actuals are stored in different tables, all you need to do is define what should appear on the chart. Now we see that the problem is weak sales in the Eastern Region. And come one step closer to turning a problem into a solution. ▶

▲ By exploring your data with CLOUT—our natural query language—you've managed to pinpoint the entire problem by typing in one sentence. From this point on, the answer looks to be a visit to the distributors. Which is about the only thing CLOUT can't do for you.

And that, in a nutshell, is what it's like to play with R:BASE System V—along with our R:BASE Graphics and R:BASE CLOUT options. The whole process is simple, natural and intuitive.

FACT FILE

Freelance Plus,
Version 2.0
Lotus Development
Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(800) 248-8002
(800) 345-1043 (for
Maps packages orders only)

List Price: $495. Optional packages:
Continents and Countries, $145; U.S.
Counties, $145; U.S. Three-Digit ZIP
Codes, $145; U.S. Major Cities and MSAs,
$145; U.S. Complete Set, $395.

Requires: 384K RAM for PC, XT or AT;
640K RAM for 3270 PC; two disk drives or
hard disk; DOS 2.0 or later.

Supports: IBM CGA and EGA; Hercules
monochrome/graphics card. Dot matrix, ink
jet, and laser printers; plotters. Polaroid
Palette, Matrix QCR, Matrix PCR, and
Photometric image recorders; Video Show
160 presentation system.

In Short: *Freelance Plus* combines numeric
graphing capabilities with the free-form tools
of the graphics artist: graphics images may be
imported and exported in several ways and
customized to a high—and successful—degree. Not copy protected.

CIRCLE 887 ON READER SERVICE CARD

Freelance Plus allows you to edit your images once you've created the basic chart. For instance, it's easy to resize and reposition labels, titles, text, and legends. The lines and boxes around the images below were simple additions. The maps below come from the package's predefined library of 500 common symbols. Freelance Plus output the image reproduced here to the Matrix QCR image recorder.
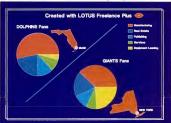
symbol sets that furnish maps of the United States divided by county, major city, and three-digit ZIP code boundaries are available at extra cost. In addition, you can alter and resize all the symbols.

Freelance Plus offers freehand drawing, with a mouse or digitizing tablet as an input device. This way you can trace existing images, including logos or diagrams, and add them to any screen. While these drawings can be edited and manipulated like other image elements, *Freelance Plus* is not intended to be a paint program. It doesn't offer you a variety of "brushes," for instance, nor does it give you the kind of control over each dot (pixel) on a screen that painting programs give you.

In addition to standard number-based graphs, *Freelance Plus* creates the kind of text charts that are commonly used in business meetings and presentations. A sophisticated facility for building "bullet" charts enables you to design a standard format that includes favorite indentation, type

style, and color settings. This chart then serves as a predefined template for the text, so that you can concentrate on the meaning of the words rather than the details of how they will be displayed.

Freelance Plus can produce graphs from numeric data that you enter directly or import from *1-2-3* or dBASE. While the program can read files stored in *1-2-3* graphic form (.PIC), a new feature allows data stored in Symphony or *1-2-3* worksheet files to be imported (a logical addition, since Lotus recently purchased the company that originally designed *Freelance*).

To create charts from the data, you fill out an on-screen form, customized for the

desired style of graph. You indicate the information for titles, labels, legends, and data points through references to parts of worksheet files. *Freelance Plus* incorporates the same conventions as *1-2-3* for describing and naming ranges of data.

CONTEXT-SENSITIVE HELP The software is particularly easy to use, especially if you're already comfortable with *1-2-3*'s "point-and-shoot" style menu. Clear messages about current options or what to do next remain on the screen at most times. Detailed context-sensitive help is available at the push of a function key. The interface is highly interactive and intuitive. The image of the current work in

progress is visible on the screen nearly all the time, with additions and modifications indicated through menu choices. The sizes and positions of graphic elements are indicated through extensive use of the cursor keys, although the alternative use of a mouse or a digitizing tablet is faster and more flexible.

Freelance Plus gives you a remarkable degree of control over each part of an image; you can break down a complex graph into its individual elements—whether it was created by drawing on the screen or generated from numbers in a 1-2-3 spreadsheet. For example, you can resize or reposition individual labels, titles, text, and legends. Moreover, you can separate and manipulate individual bars in a bar graph or slices in a pie chart.

A variety of supported output devices add to Freelance Plus's versatility. Most popular dot matrix printers and plotters are supported at their highest resolution. The package supports several film recorders, including the Polaroid Palette and Matrix PCR, allowing output to 35mm slides. The Video Show 150/160 device displays images on a video screen. You can also export images in the "Metafile" format, meaning that they can be imported by Lotus's new document-processing program, Manuscript.

The thorough Freelance Plus documentation consists of separate installation, tutorial, and reference sections. The technical support provided by the Graphic Products Group is consistent with Lotus's high standards.

Designed as a full-featured graphics package meant to meet the needs of a wide variety of business users, Freelance Plus succeeds admirably. It may be more powerful than necessary if you're primarily interested in using graphs for analysis, but you'll find it well suited to your needs if you're familiar with—and eager to try out—the graphics arts techniques used for presentation and publication.

—David Hoffman

GEM Graph

Gems are expensive, pretty, and desirable. Digital Research's GEM Graph manages two out of three: upscale price and attractiveness.

For $249 you get GEM Desktop, a shell that houses the applications (plus a clock, calculator, and print spooler) and GEM Graph. But to take full advantage of the GEM features you need to add GEM WordChart ($149), GEM Paint ($199), and GEM Draw Plus ($299) for a grand total of $896, plus a mouse (which is required; cost at least $100). Once loaded, GEM Graph uses a Macintosh-style icon interface. While installation is not difficult, you'll need more than 700K bytes on a hard disk drive, and GEM Graph creates five directories off the root directory in the process.

You can create standard pie, line, area, bar, and 3-D bar charts with GEM Graph, as well as bar and line combinations, map charts, and symbol graphs. Data can be entered manually in the easy-to-fill-out data window or read directly from .DIF, .SYLK, .WKS, .WK1, .CSV, and .PRN files.

After inputting the data, you choose the gallery menu to display the graph types available. Click on the style you want, a

display window overlaps the data window, and GEM Graph proceeds to draw your chart. Toggling between the two windows is easy enough to do and any data updates are redrawn with the toggle back to the display window.

A customization tool kit appears next to the chart, showing the eight-color on-screen palette and the pattern boxes that can be used for fills. If you make a symbol chart, GEM Graph will provide 12 symbols in place of the pattern fills. If you get GEM Draw, you can create an unlimited number of your own symbols and import them into GEM Graph.

Fifteen lines of free-form text with up to 40 characters per line can be written into the chart. Placement is manual, so evenly aligning columns is rather difficult to do. A GEM Graph magnify option helps somewhat.

From the data window, titles, legends, and labels are automatically placed in the chart. In addition, some of the elements can be dragged to different areas. Which ones? The only way to find out is by trial and error.
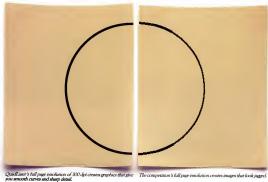
The font menu offers but a single font to work with (the upcoming Version 2 will offer two). You can also select type size, from 10 to 72 points, and type format, including normal, boldface, italic, underlined, and boxed.

Another menu contains the style options to adjust the axis scale, turn grid lines on or off, and place labels within a legend. Depending upon which chart type you choose from the gallery menu, GEM Graph offers different preference options. Another selection lets you switch from a standard graph (two dimensions) to an enhanced graph (three dimensions).

IMPRESSIVE CHARTS You can create impressive charts with GEM Graph, and output them to printers, plotters, and image recorders. Output is done from the display window without leaving the work area. GEM Graph can successfully plot only two-dimensional charts. Any highlighting that would make a graph 3-D can make plotter output totally unreadable.

GEM Graph comes with two manuals, for GEM Desktop and for Graph. Before you can adequately use GEM Graph you must be familiar with GEM Desktop be-

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MANUFACTURERS' ENGINE LIFE RATINGS

QUADRAM
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With Digital Research's GEM Graph, you can create impressive charts. Output is designed to go to a high-quality printer or image recorder but not to a plotter. Because of a limitation in the plotter drivers, any highlighting that would make a graph 3-D is plotted first, with the successive fills, or colors, plotted on top, making the chart totally unreadable. This pie chart was produced on a Xerox 4020 ink jet printer.

GEM Graph

How That Will Change With the Merger

- 62%
- 4% — Manufacturing
- 9% — Real Estate
- 12% — Publishing
- 13% — Services
- Equipment

cause it is the shell that contains all of the applications. The tutorial in *Graph's* manual is to be commended. It is short, simple, and to the point.

GEM Graph has a lot to offer: quality graphs that are easily created and modified. But *GEM Graph* has much going against it, too: by the time you add all the modules to access the features and the mandatory mouse (if you don't yet have one), you're in the $1,000 range. Another consideration is the output. If you have a camera device, a high-quality dot matrix or ink jet printer, or an Apple LaserWriter, you'll be able to generate impressive output. If you rely on plotters, forget it.

—Christopher Barr

GraffHopper and Graphic Decision Support System

Data Business Vision's *GraffHopper* is difficult to learn but fairly easy to use—once you've mastered its menu and command strategies and its syntax. *Graff-Hopper* also requires a significant amount of effort (it could be a programmer's dream). Nevertheless, it offers flexibility and control of graph display and printing. *GraffHopper's* greatest strength, though, is its Chart Book, a collection of 101 pre-formatted graph types.

You control *GraffHopper* either by us-

ing a vertical menu or by issuing commands at a command line, and both of these methods are fairly crude. Some of the command-line prompts are particularly cryptic. But after you've learned how to use *GraffHopper*, you can really make it jump by using commands instead of the menus. Until you get to that point, you may find yourself struggling.

GraffHopper calls data groups "curves." You must always start with curve 2. Curve 1 is used to establish reference points. That setup can be confusing, especially for novice users. The program could use a more accessible user interface.

Luckily, *GraffHopper's* extensive manual includes both a quick overview and a more comprehensive walk-through that covers all of the program's features and functions. The manual is generally good; one especially praiseworthy feature is the cross-reference index in the back.

GraffHopper is steady on its feet. Try as I might, I was not able to make it crash. In each case, the program came back on its own after trying to do such things as write to an unformatted floppy disk or print to an off-line printer.

The program makes good use of its Chart Book, a collection of 101 different charts to use as examples and to modify your own data. Using the Chart Book is the best way to use *GraffHopper*; you merely find the type of chart you want and then answer a series of not-too-tough questions about titles, data, and labels. This facility is the only way beginners will be able to use the program at first. It also points out *GraffHopper's* greater potential for user-customized graph parameter settings. You can set up your own command files with an ASCII line editor to control graphs.

GraffHopper lets you see the graph in various stages as you create it—a conve-

nient feature. To see what you have creat-
ed so far, you can use the Go command from most menus. Once you have the graph the way you want it, you can save ei-
ther a picture file of just the graph image or all of a graph's specifications.

SERIOUS DRAWBACK I had no prob-
lem plotting *GraffHopper* graphs on the Hewlett-Packard 7470A plotter. But I couldn't manage to print them on my graphics printer. When I asked the techni-
cal-support staff at Data Business Vision what went wrong, they told me that most of their customers use plotters or serial dot matrix printers, not graphics printers. They advised me to use the Alt-P print-

screen technique to dump the screen con-
tents to a parallel printer, but even that method requires your first making some changes to the printer command file. This problem is a serious drawback for a gener-
al-purpose graphics program like *Graff-
Hopper* because more users have parallel graphics printers than any other output de-
vice. The helpful support staff say they will assist all users the way they aided me, but be warned that printing on graphics printers can be tricky.

If you need extra power, Data Business Vision also offers *Graphic Decision Sup-
port System (GDSS)*, a superset of *Graff-
Hopper*. GDSS includes all the features of *GraffHopper* and adds a database and a

Since *GraffHopper* is both a standalone package and the graphics module for Graphic Decision Support System (GDSS), which adds a point program, a database, and a data query function, the features and charts produced by both packages are the same. We, therefore, reproduced the same images for both. The packages output to printers, plotters, and a wide variety of image recorders. The pie chart below was created using the Matrix PCR film recorder.

data query function, as well as a paint program. The essential command structure is the same as that of *GraffHopper* (since *GDSS* actually includes *GraffHopper*), and the basic charts that the two programs produce are identical. Yet the extra features of *GDSS* allow you to significantly enhance the appearance of the charts—if you take the time to learn the extra commands. If you need this extra power, particularly the ability to make decisions based on a graphic representation of your database, then *GDSS* is worth considering.

Otherwise, *GraffHopper* is best suited for intermediate to advanced users. For beginners, the effort required to master the program overbalances the convenience of the 101 preformatted graph types and the command-file-customizing ability. Novices will want a program with a more accessible user interface. But if you're not a newcomer and don't mind some extra effort, you'll appreciate *GraffHopper's* ability to let you completely customize the layout and the appearance of your graphs.—Bruce Brown and Jon Pepper

Grafox, dGRAPH, and R:graph

We looked at three Fox & Geller graphics programs for this issue: *Grafox*, *dGRAPH*, and *R:graph*. *Grafox*, the eldest of the three programs, is an easy-to-use but limited business graphics program. Its offspring, *dGRAPH* and *R:graph*, are a bit more advanced, and each is designed to make the best use of files that are created with a certain database program: *dGRAPH*, files from *dBASE III* and *dBASE III Plus*; *R:graph*, files from *R:Base*.

GRAFOX *Grafox*, Version 1.0, combines several features to automate the customizing of graphs. While *Grafox* limits you to using only a few graph types (bar, line, pie, and pie bar) and fairly simple data entry types and labels, its simple menu structure and its flexibility make it a likable program.

Installing *Grafox* is easy and goes without a hitch. *Grafox* doesn't support the EGA graphics standard, though, and will not display color without a Color/Graphics

---

Adapter in the computer—even with a fancy EGA switching graphics card.

Grafox's error-trapping system is sufficient but not faultless. Reading and writing with a disk drive with an open door or with an unformatted disk takes you to the DOS "Abort, Retry, Ignore?" prompt. Closing the door or putting in a formatted disk and then trying again recovers the program. If you Abort, however, you're sent to DOS with no files saved. Trying to print with no

---

printer attached or turned on brings a "Printer Not Ready" message; you can recover by striking the Esc key. The most serious problem came from trying to print with the printer off-line. The program hung, and I needed to reboot the computer. (*Grafox's* descendants, *dGRAPH* and *R:graph*, were steadier on their feet: they didn't hang.)

The extensive screen images in *Grafox's* manual walk you through the program's functions step by step. This method uses a lot of pages but certainly simplifies learning the program.

Grafox's bar, line, pie, and pie bar graph types each have a specific option menu that you can use to preset such functions as printing to the screen, printer, or plotter and saving the file. Single-letter menu commands select all *Grafox* functions. Options for row labels include month or number formats or other data. If you choose months or numbers, the program automatically generates the text for the labels.

Grafox has some fairly severe drawbacks. Numeric entries must be either whole numbers or have one decimal point. You can have only four data sets per graph. Legend titles for data types are restricted to nine characters each. Getting around these limitations may be more bother than it's worth.

One *Grafox* feature I especially like is the ability to print text files immediately below graphs. You cannot use *Grafox* to cut and paste with other programs, but it's very convenient to be able to add a paragraph of explanatory information at the bottom of a chart. Another convenience is the program's ability to clone a data file, and then eliminate its entries but keep the other settings.

Besides allowing you to enter data directly, *Grafox* can also import data from both BASIC and .DIF files. Because these processes are a bit complex, it's a good idea to know how you want your graph to end up looking before you actually start importing data. Casual users will want to think twice about using *Grafox* with BASIC or .DIF files.

Grafox includes an advanced command capability with which you can instruct the program to perform major functions without ever working within *Grafox* itself. For

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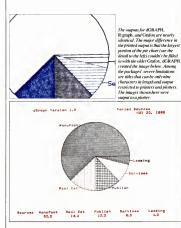
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The outputs for dGRAPH, R:graph, and Grafox are nearly identical. The major difference in the printed output is that the largest portion of the pie chart (see the detail to the left) couldn't be filled in with the older Grafox. dGRAPH created the image below. Among the packages' severe limitations are titles that can be only nine characters in length and output restricted to printers and plotters. The images shown here were output to a plotter.

example, the command Grafox "Costs" Print will cause Grafox to load a chart file called Costs and send it directly to the printer. If you often use a lot of the same charts, this direct command mode is a valuable timesaver.

Grafox's ability to customize graphs and to automate printing to screen, printer, and plotter is admirable. At $195 the program is a bit expensive for the simple business graphing needs it fulfills, but it is certainly worth consideration.

dGRAPH AND R:GRAPH Fox & Geller's dGRAPH and its sibling R:graph are almost identical to their predecessor, Grafox. One difference is price: dGRAPH

and R:graph cost $295 each, $100 more than Grafox. The other noticeable differences are that dGRAPH and R:graph use IBM keyboard function keys when setting graph options rather than Grafox's single-letter commands. They also accept data from different formats and use a few more prompts before printing or plotting graphs and before exiting the program. The difference between dGRAPH and R:graph is simple: dGRAPH is designed to import data from dBASE, while R:graph is designed to import from R:base.

dGRAPH and R:graph also include a quick-reference card—missing from Grafox and much needed. Each program's manual is almost exactly the same as Gra-

fox's, from table of contents to most of the text.

dGRAPH's and R:graph's raison d'être is to import files directly from dBASE and R:base and to produce graphs from the data. Grafox will import only BASIC and .DIF files, which neither dGRAPH nor R:graph support. When you are importing dBASE and R:base files, with dGRAPH and R:graph, you specify the fields to use and their organization by carefully following on-screen prompts. With dGRAPH, if you want to use a file created with dBASE II, you must either run dBASE III's convert program or rekey the data in dBASE III. Otherwise dGRAPH's file importing works very smoothly.

A convenient feature that both dGRAPH and R:graph share with Grafox is that they can print a Chart Definition sheet, which lists filenames, titles, limits, and scaling and option settings for a given chart. This feature is especially convenient to use when referring to saved settings; it can greatly simplify the task of producing charts from monthly or other periodic reports from your database files.

dGRAPH and R:graph are expensive add-ons for dBASE III, III Plus, and R:base, but if you produce similar charts periodically, their chart automation and advanced command language can quickly pay off.—Bruce Brown

Graftime

Genigraphics Corp. is a manufacturer of computer graphics equipment for the production of slides that ranges in price from $30,000 to $150,000. Now with its new program, Graftime, anyone with a PC can afford to create well-designed, high-quality graphics for output to a wide variety of devices.

Graftime has 14 chart types, including the basic graphs (line graphs, bar graphs, and so on), word charts, tabular charts, and organizational charts. You can set up a style sheet, with your choice from five palettes, three font types, drop shadow, and borders, to govern all the charts in a presentation.

The range of options may be too limited for some applications: only five palettes, no data import from other programs, not much variation in type size, and no more

than eight slices in a pie chart or four sets
of values per line or bar chart. Neverthe-
less, the charts have a certain elegance that
you would expect from a descendant of
Genigraphics' professional graphics sys-
tems, and it was easier to produce good-
looking charts with this package than with
some of the others reviewed here—espe-
cially those that began as spreadsheet ad-
juncts. If your emphasis is on statistical de-
tail, a package in the latter category may be
more appropriate. If you are a nontechni-
cal designer who wants to see the results of
changes in palette quickly, an executive
who wishes to use the program occasional-
ly, or part of a graphics department for
high-volume production, *Grafime*'s fea-
tures should be suitable.

Grafime works through a menu sys-
tem, using function-key commands for
common operations such as preview chart
and print. Picking menu choices results in
on-screen forms in which you enter titles,
labels, and all other information required
to generate charts. You can use the Tab or
cursor keys to move around and fill in the
information in any order. It was easy to
follow the menus and set up our charts,
without even studying the manual or going
through the tutorial.

There is an optional on-screen chart-
previewing function, which requires a
graphics card. After we viewed our chart,
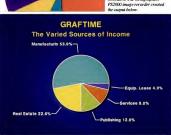
it took only a short time to redraw it on-
screen since it was easy to jump from a
chart to the main menu, change the set-
tings, and redraw the chart to see the ef-
fects of the new settings. You can change
data values for a chart and add or delete
bars at any time.

HIGH-QUALITY OUTPUT After you
are satisfied with what you see previewed
on-screen, you can produce high-quality
charts on a number of output devices, in-
cluding most plotters, dot matrix printers,
HPGL devices, the QMS Lasergrafix
printer, Polaroid Palette, Samurai, or Gen-
igraphics high-end equipment. In addi-
tion, *Grafime* includes built-in data com-

munications software that lets you transmit
charts from a PC to a remote console, film
recorder, or data collector.

Overall, *Grafime* can satisfy a wide
range of needs (except statistical applica-
tions): it is easy to use, is capable of high-
quality output, lets you start with any
320K-byte PC (even though you can't pre-
view charts without a graphics card), and
prints to high-end film recorders, as well
as almost any dot matrix and ink jet printer
and plotter. The program incorporates the
full range of chart types required by most
presentations, with style sheet settings that
globally affect all the charts in a set. Alto-
gether, *Grafime* offers excellent value for
the money.—Diane Burns and S. Venit

Charts produced with Grafime
*have a certain elegance
appropriate to a descendant of
Genigraphics' professional
graphics systems. It is relatively
easy to create good-looking charts
with this package. The package
can produce output using printers,
plotters, the Polaroid Palette, and
any of Genigraphics' image
recorders. The Genigraphics
PS2000 image recorder created
the output below.*

GRAFTIME
The Varied Sources of Income

Manufacturin 53.0%

Equip. Lease 4.0%

Service 9.0%

Publishing 12.0%

Real Estate 22.0%

GraphPlan

One of the oldest graphics program products reviewed in this issue, *GraphPlan*, from Chang Laboratories, is also probably the only program whose manuals list CP/M-80 as a supported operating system and give instructions on how to use PIP (the CP/M precursor of the MS-DOS COPY command).

How well does *GraphPlan* stand up to the rapid changes of the past 4 years? Well, it has a number of interesting and useful features. You enter data in a row-and-column format, and you can define rows or columns as mathematical combinations of other data elements. You can use a rule to fill a range of data elements, incrementing them by a fixed amount or a percentage, or just entering a constant in all the cells. In fact, you end up with a limited spreadsheet with which to work. A series of options gives you even more control over the printed report version of your data table.

GraphPlan also includes a variety of powerful statistical functions, including standard deviation, variance, natural logarithms, moving average, and exponential smoothing. You can sort rows to reorder the data if you wish.

The graphs the program enables you to create include the standard bar, line, and pie charts. You can choose horizontal and stacked options for the bar charts. In addi-

GraphPlan allows you to create the standard charts, including bar, line, and pie. But the package imposes real limits on producing a graph. It imports no data, leaving you to key it all in yourself. And once the data's there, you can use one font in two sizes and display only the standard CGA four colors. The package outputs only to dot matrix and ink jet printers and to plotters (used to create the image shown).

Real Estate 13%
Publishing 12%
Services 9%
Equipment Leasing 4%
Manufacturing 62%

tion, the program gives you control over the shading patterns and colors used to create your images.

Unfortunately, though, *GraphPlan* sets real limits in your way when you're creating a graph. You are permitted only one title line, for instance. And the only position for the *y*-axis label is on top of the graph; the *x*-axis label can go only below the graph. You get only one font for titles and labels, and you cannot even make it bolder or italic.

YOUR AGE IS SHOWING *GraphPlan*'s limitations would be acceptable if it were a low-cost product that emphasized ease of use at the expense of power features. But the program's age shows through all too clearly in the user interface, coming as it does from the time when programmers could not afford to expend too many bytes on user commands and menus. As a result, *GraphPlan* presents you with a cryptic column of prompts down the right-hand side of the screen. Some selections execute commands, while others merely change the menu to another set of prompts. After you complete an operation, you may or may not be returned to the original list.

It's an unfair to call these lists menus, since you must make your selection by typing the desired command's number on the command line near the top of the screen. You can actually type in any com-

mand number you wish; it does not have to appear in the list to be active. But you probably won't memorize all of *Graph-Plan*'s more than 100 commands.

Not only is *GraphPlan* difficult to use in terms of its interface, it's also slow. Its poky pace is partly due to the fact that it relies on ANSI.SYS for its screen control—an old-fashioned solution, made worse by the fact that the installation instructions barely mention it. If you're installing *GraphPlan* on a hard disk, you'll find no help at all. Unless you are familiar with the use of ANSI.SYS and its role in a CONFIG.SYS file, you might well be confronted by confusing "garbage" on your screen when you first try to run the program.

GraphPlan's documentation doesn't do much to hold up its end of the operation. It dates from 1983 and relies heavily on examples; the essence of the reference material is sometimes difficult to locate—and sometimes wrong (the tutorial section instructs you to enter values that, when I tried, the program wouldn't accept, and some prompts in the book did not match those on the screen). As evidenced in addition by its lack of tolerance for open disk drives and full floppy disks, *GraphPlan* is not a program for a neophyte.

With limited control over your graphs, a steep learning curve to get the hang of the command system, and little room for error in how you handle the program, *Graph-Plan* offers less than it demands. Not all things improve with age.—**Alfred Poor**

••
GraphStation
If you're serious about getting on the graphics train, plan a stop at Software Clearing House's *GraphStation*. You can assemble just about any sort of graphic you wish and send it to a variety of printer and plotter destinations. With all this power comes a complex interface that's easy to use but difficult to master.

GraphStation does it all. You can create the usual bar charts, line graphs, pie charts, and combinations. It also gives you advanced features like three different curve-fitting algorithms (running average, Fourier, and polynomial best fit), text screens, free-form text on graphs, batch printing of graphs, and a slide-show mod-

ule. A complete "paint" module offers free-form and controlled line drawing, standard shapes, fill patterns, image manipulation, and even an airbrush feature. You can use the paint functions on a graph image. You can also store graphs as images and combine them on a single screen; you're limited only by the resolution of your output device and how much your audience can read on a single page at a time.

Each of these features embodies dozens of options to dress up your image. For example, for text alone, you can choose among eight fonts, change the size and spacing, and even display it at different angles, including upside down. You can also add shading. Plus you can center text or align a number of lines with a selected line.

You select all these options from a series of menus that appear on the left-hand side of the *GraphStation* screen. You'll want to use a mouse if you're going to use *GraphStation* for any length of time. Fortunately, a Mouse Systems Corp. mouse is now bundled with the program, along with another graphics program called *Pizazz*, which adds support for more printers. (Neither of these products was included with our review copy of the software, and

As evidenced by its lack of tolerance for open disk drives and full floppy disks, *GraphPlan* is not a program for a neophyte.

we were unable to evaluate them.)

GraphStation has some interesting features for data import. You can use *1-2-3* worksheets or ASCII files as your source data. If you use ASCII, you display the file on the screen and highlight the items you wish to bring in as datasets. You can even display a report and pick the numbers out of the paragraphs if you want. Once you're working with the data, you can actually change a data point's value by moving the point on the graph; not only will it recalculate on the basis of a formula (imported from a spreadsheet), but you can update the values in the original spreadsheet by writing the data back out as a worksheet.

FACE THE INTERFACE
The consistent user interface is easy to use if you know what you want to do or if the options are readily apparent. But a program this complex requires dozens and dozens of options for all its features, and these cannot all be present on the screen at one time. Using submenus makes sense, but to make them orderly, *GraphStation* waits until you select an image item (such as a bar, an axis, a title, or a legend) before it shows you the menus that go along with that type of item. It's hard to fault a feature of a program that exhibits such care and thoughtful design, but I found the arrangement confusing and feel I would have to work with the product for a long time before I felt comfortable about where all the options are hiding. I prefer the *1-2-3* approach, where all suboptions are conveniently displayed at one time so that you don't have to
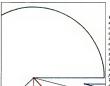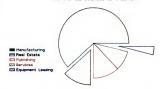
With GraphStation, you can dress up your image as we did here by centering text and changing its size and angle. You can also select individual pie segments for exploding, moving each one to any desired position. Unfortunately, the graph shown below lost much in the translation because the version we reviewed has limited compatibility with the HP 7470A plotter used in our evaluations. The next version will correct this deficiency.

GraphStation
The Varied Sources of Income

- ■ Manufacturing
- ▨ Real Estate
- ▩ Publishing
- ▨ Services
- □ Equipment Leasing

guess about what you can do next.

Perhaps my reaction to GraphStation's user interface would have been different if its manuals were better. The 400-page reference manual has a decent index and sufficient examples in most cases, but it is difficult to navigate through without tabs as landmarks. The tutorial manual is more than 130 pages long and does a fair job of introducing you to the program's philosophy and some of its features. Explaining the program is no small task; the reference manual uses six pages just to list all the different commands.

The program's wonderful output is worth the effort required to get to know all the options. For plotting, GraphStation of-

fers you three speeds. You can get a quick draft with rough letters and no shading, or a perfect image in extremely fine resolution.

With its good-quality output and its many features, GraphStation goes the distance. But it's not an express ticket be prepared to spend some time mastering the possibilities.—**Alfred Poor**

Graphwriter

Lotus Development Corp.'s Graphwriter is an excellent tool for anyone who makes presentations frequently or for a department that needs to prepare all of the materials for a group of presenters. It is a compre-

hensive graphics package that comes with 28 basic chart formats and a special format with which you can produce presentation materials such as slides and overhead transparencies. And if you want to be even more creative, you can use Lotus's *Freelance* to add, edit, and rotate graphics elements.

Graphwriter is an easy-to-use, practical program designed with insights into what a presentation needs: in addition to offering a wide variety of charts, including Gantt charts, organization charts, bubble charts, table charts, and a "word chart" format that enables you to design a complete set of presentation materials, it lets you build a style sheet to ensure consistency among the charts. The package also comes with a set of blank forms that can be used to collect data for charts and information such as paper size, plot area, and graph orientation. The forms also have areas for name and phone number, date submitted, and date due, thereby serving as job sheets in a production environment in which the person requesting the charts is not the same as the one using Graphwriter to produce them.

The program opens with a main menu of six clearly stated options: Change to Another Format, Enter or Change Chart Data,

Change Chart Style, Print Data, Store Chart, and Plot Chart. The options branch out into 11 submenus; it's easy to find your way around, with most of the menu selections giving you a series of screen prompts or questions that you answer in sequence. The package also comes with a 16-page booklet that includes a map of the menus, along with many other quick tips and reference notes.

Graphwriter is easy to get into and use; we rarely had to refer to the comprehensive 300-page reference manual. We did find one flaw, however: there's no easy way of going back one step if you change your mind or make an error. We generally had to go through the full list of prompts associated with a command if we wanted to go

back and change specific entries.

Graphwriter allows you to type data directly into it or to pull in figures from spreadsheets saved in .SYLK or .DIF format. When you generate *Graphwriter* charts you can enter up to three heading lines at the top of the chart, up to three note lines at the bottom, up to three comment lines inside the chart area, and a legend on the right. Although you have a choice of whether or not to enter the text, the layout is standard and where you enter text cannot be changed.

TYPE DEPENDS ON OUTPUT There are different typefaces available for the text, which vary depending on your output device. For example, with plotters there

are eight fonts plus 11 colors. You can specify type size of up to 100 millimeters and the typeface for any text simply by giving the type font and a size percentage. You also have a choice of palettes, fill patterns, line types, marker types, chart sizes, and borders. You can store and use specific style files for all the charts in a set.

You can store charts in two ways (as individual data and as composed charts) and will probably want to store most charts both ways. If you store chart data, you can call it up at any time and change the data or style of the chart; if you store a composed chart file, you can set up batch processing to print a series of composed files, but you cannot change a composed file. (Batch processing means that you can build a large number of charts and print them all at once on a plotter or send them through an image processor.)

Once you have specified the data and text for a chart, you can plot it on-screen before sending it to a printer. *Graphwriter* prints to a wide range of printers and plotters, including Epson dot matrix printers, the HP LaserJet, and HP plotters, as well as to the Polaroid Palette and other image recorders for slides.

Overall, *Graphwriter* is a flexible and efficient presentation tool, most suitable for those who don't mind working on text screens during most of the charting process. With word charts, style sheets, and batch processing it is easy to generate or change a full set of presentation materials. The graphs themselves are clear and effective, but we recommend you also get *Freelance*, Lotus's freehand drawing program, if you want to make them exceptional.—Diane Burns and S. Venit

Graphwriter is a comprehensive graphics package that comes with 28 basic chart formats. The package provides different typefaces for the text, and you can also specify any text size by entering the type font and a size percentage. Graphwriter prints to a wide range of printers and plotters and outputs to several image recorders, including the Matrix QCR used to create the chart shown here.

Created with LOTUS Graphwriter
The Varied Sources of Income

Manufacturing

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Services

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GSS-Chart

Working with *GSS-Chart*, from Graphic Software Systems, is exactly like working with an Apple Macintosh. You choose functions by pointing to icons, symbols on the screen that represent various operations. *GSS-Chart* has several fancy features, including a paint program and an on-screen text writer that allows you to customize and comment charts freely. The icon-selection user interface is *GSS-Chart*'s greatest attribute—a powerful feature that by itself may very well be worth

GSS-Chart's paint program lets you put arrows, circles, rectangles, and lines anywhere you want, and you can use the text annotation feature to insert lines of text anywhere in your chart. You can also choose the type font, size, and location of text. The image below was output by the MagiCorp service bureau using the Celco CFR-4000, a high-end film recorder available only for commercial applications.

GSS-CHART 1.0
The Varied Sources of Income

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the program's $295 price tag.

You control all operations and select features in *GSS-Chart* by icon selection. For example, writing text is represented by a pencil tip, erasing by a pencil eraser, and output by a picture of a printer. You select a function or option by positioning the graphics cursor (which looks like an overgrown plus sign) on the icon/symbol and hitting the Enter key or the mouse button if you're using one.

It's fun to use *GSS-Chart.* I quickly found myself moving from feature to feature to function to operation without worrying about syntax or spelling. At those times when you absolutely do have to key in information, such as when entering data or filenames, the cursor changes from the graphics cursor style to a blinking block cursor. When you finish with the data or filename, the graphics cursor returns.

Besides a marvelous implementation of icon selection, *GSS-Chart* has several other top-notch features. There is a paint program that lets you put arrows, circles, rectangles, or lines wherever you'd like on your chart. You can choose colors from a changeable on-screen color palette. Simi-

larly, you can use the text annotation feature to insert lines of text anywhere in your chart; you can also dynamically choose the type font, size, and the location of the "box" of lines of text. You can build some pretty fancy charts using the drawing and text annotation features.

GSS-Chart has a helpful calculator function that you can use to perform operations with individual data items or sets of data. There are also several numeric operations such as accumulation, smoothing, and absolute value built right into the program. These functions can be extremely useful in converting raw data for various reporting purposes.

Even though *GSS-Chart* uses the popu-

lar icon point-and-shoot technique, you will do well to carefully follow the manual's instructions at first. The program includes on-line help, but it's a bit sketchy; you will want to refer to the manual for your first few charts.

EASY INSTALLATION *GSS-Chart* is memory hungry, requiring at least 512K bytes. Installation is simple via a GSS-Device Driver disk that rewrites your CON-FIG.SYS file to include the drivers that *GSS-Chart* insists on. Clear information screens guide you through installation, but you have to pay careful attention. Even though there is a separate installation disk and documentation, some necessary infor-

mation is lacking. I had to call customer support to make the program work properly with my printer and plotter. When I called, however, the customer-support staff was pleasant and answered questions immediately.

GSS-Chart is not exactly bulletproof. When I tried to write to an unformatted disk or to a disk drive with the door open, or to read under the same conditions, I received the disk failure "Abort, Retry, Ignore?" message. When the given condition was corrected the program came back successfully, but it would be better if it error-trapped for those problems. If I tried to write to a nonexistent subdirectory, that didn't fool the program: GSS-Chart indicated that it couldn't "connect to" the directory. Sending to off-line or nonexistent printers hung the program until the printer was turned on or brought on-line. There were worse results with writing to a full disk. No message told me the disk was full. Subsequently looking at the directory of the full disk revealed that the filename was in the directory, but that the file itself was only 0 bytes long. You would assume that your data was saved, then exit to find your file gone. GSS should improve the program's error-trapping.

The error-handling ability is the same as that of GSS-Chart's sibling, GSS-Plottalk. GSS-Chart is easier to use and offers several extra features (a rudimentary paint program, the ability to display four charts on-screen, and .DIF and .SYLK file import), while Plottalk is faster. Both cost the same.

GSS-Chart is the answer for those who want to create and modify graphics by icon selection. The program is easy to use once you've learned its organization.
—Bruce Brown

GSS-Plottalk

If icon-controlled programs like GSS-Chart are for yuppies, then GSS-Plottalk is for Crocodile Dundee. It's tough, fast, and gets the job done with no foolishness. Graphic Software Systems' GSS-Plottalk is entirely command driven. You have to learn its language, but once you do, this may be the fastest graphics program going. At $295, the same as its more effete sibling GSS-Chart, Plottalk may well appeal to

power-hungry computer users more than Chart.

At first GSS-Plottalk doesn't seem easy to use. Once you've installed the program with the GSS Device Driver disk, loading GSS-Plottalk confronts you with a lonely ">" at the top-left-hand corner of your screen. The realization that you have to tell it everything to do, rather than choose from menus, sinks in, and you may start to wish you'd bought GSS-Chart. Don't despair: while GSS-Plottalk has many commands, you need less than a dozen to get started.

The language interpreter in GSS-Plottalk is quite liberal. Many commands have synonyms, such as Draw and Go. You can also issue commands as sentences: "Please make the y axis type percent" or abbreviated, "y tick %"; both accomplish the same thing. A final command form is the imperative: "Frame the chart." This diversity of language acceptance encourages you to experiment with commands and lessens some of the concern about exact syntax.

A three-lesson tutorial booklet walks

you through creating several charts keystroke by keystroke. I was quickly charmed by this program's lenience with language and pleased by its responsiveness. By the time I finished the tutorial, I felt ready to use all of the program's features—a fine measure of effectiveness for any tutorial.

EASY WINNER PC Magazine has no test for how quickly a chart can be built and displayed on the screen, but if it did, GSS-Plottalk would be one of the winners. While other programs show you opening screens and require you to step through menus, GSS-Plottalk takes your commands as quickly as you can type them and displays your chart on the screen whenever you type Draw or Go.

Anytime you want to review the commands used in creating a given chart, you simply type the command List and your commands are displayed on the screen, just like a program listing. When you save a GSS-Plottalk chart you actually save an ASCII file of commands, which means you can also use your word processor to indirectly create and control GSS-Plottalk graphs.

GSS-Plottalk did not do too well on our error-trapping tests, the same as GSS-Chart. Nonfatal halts occur if you try to read from or write to open disk drives or unformatted disks. There is no problem writing to a nonexistent subdirectory. Sending to off-line or turned-off printers hangs you up only until you correct the faulty condition. The greatest potential problem, as with GSS-Chart, occurs if you write to a disk that's full or doesn't have enough room. The documentation states that this condition will be caught; however, when I tried it the program wrote the file title to the disk directory but the contents were not there. Nothing on the screen gave the slightest indication that my data wasn't on the disk.

The GSS-Plottalk user manual is basically a reference manual, but a good one nevertheless. Each command is explained completely, with suitable examples provided. A quick-reference card is also included to further aid users.

GSS-Plottalk includes many options for charts. You can select hatching patterns, colors, fonts, positioning points, frames,

GSS-Plottalk's greatest appeal is speed: a command-driven interface lets you breeze through chart creation. To add visual interest, you can select hatching patterns, colors, and fonts. The image shown here was output by the MagicCover service bureau using the Celco CFR 4000, a high-end image recorder for commercial applications.

GSS-PLOTTALK 1.0
The Varied Sources of Income

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messages, and outlines, among other choices. You also can display multiple graph types on a single axis.

GSS-Plottalk's greatest appeal is speed. The language is forgiving and fun to use, and the rapidity with which you can build and display charts is a big draw. *GSS-Plottalk* is probably not for everyone—especially not for those who feel comfortable only with icons and menus. But if you've had your fill of long-winded "helpful guides" in programs, you might want to give *GSS-Plottalk* a try to see a fast program do what you ask. Between *GSS-Chart* and *GSS-Plottalk*, power users will be better served by *GSS-Plottalk*.

—Bruce Brown

Harvard Presentation Graphics

Anyone who's ever shrugged and said, "Gee, I'd sure like to do graphics, but it's just too complicated," should be shanghaied into sitting down with *Harvard Presentation Graphics* from Software Publishing Corp. Creating a graph is a quick, completely menu-driven process. The final result, in both the quality and the diversity of the charts, is equal to, if not greater than, many packages with all sorts of complicated options and shenanigans.

Harvard Presentation Graphics asks you to select the type of chart you wish to

create and then presents a user-fill-in-the-blank template. Choices are text, pie, bar/line, area, hi-low, and organizational charts, and each offers a fair amount of flexibility. For instance, you can create columns in text slides. Because you select a chart format first, then input the data, your data is married to one specific kind of chart, but because data entry is so easy it hardly matters.

The manual adequately discusses design considerations for presenting data in a graphic format. Graphs are easy to create using *Harvard Presentation Graphics'* straightforward menu selections. To create your charts, you fill out a row/column chart in which you specify titles, labels, and enter data. Pie charts require one additional form, and bar and line charts require two additional forms in which you choose other options specific to these particular graphs. For example, you can link (illustrate a relationship between two pies or a pie and column), specify color or pattern fills, or create a 3-D effect. You can select overlapped or stacked bars, display grid lines, and specify legend placement, axis increments, and other options.

The program incorporates consistent

use of the PC's function keys. F1's context-sensitive help offers detailed explanations about menu selections, and the F2 key commands the program to draw a chart on-screen for you to preview. Besides using the various data form templates, you can select F7 to adjust text sizes (each font has a number of predefined sizes) and F5 to specify font attributes, such as italic or boldface.

WELL-PLANNED OPTIONS One of the handiest options is the X Data Type Overlay menu. You can indicate the type of x-axis data you plan to graph (day, year, quarter, and so forth) and specify an increment for the data. *Harvard Presentation*

Graphics automatically fills in the values. Graphing data across months or years is accomplished in seconds, with no typographical errors. Moreover, the program can graph cumulative data as well as suppress a series of data. For example, I eliminated 1980's figures from the graph without eliminating the data for that year.

Perhaps the weakest part of the program is its annotation capabilities. A primitive *MacPaint*-like or *PC-Paint*-like interface allows you to enhance the chart by selecting various icons from the annotations menu. The enhancements include arrows, lines, boxes, and floating text. The annotation process limits you to modifying, copying, or moving annotations within the

Harvard Presentation Graphics controls the plotter beautifully, creating smooth curves like those visible in the detail to the left. Unfortunately, the program chopped the labels in the pie chart to bits because they wouldn't fit in the space allotted for text on the package's data import form, hence the abbreviations below. The image was output on a Matrix PCR image recorder.

graph; you cannot edit any portion of the graph itself. The keyboard control over the annotation process is somewhat crude and limited.

Harvard Presentation Graphics provides substantial data export and import facilities. An easy-to-use data exchange procedure facilitates data transfer. The program supports Software Publishing Corp.'s excellent line of easy-to-use business software, the PFS series. You can export charts to a *PFS:Write* document and can import charts or worksheets created by Lotus's *1-2-3*, *Symphony*, and *PFS:Graph*. You can also import data in ASCII format.
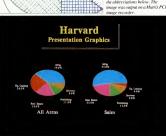
In addition to its prowess as a chartmaker, *Harvard Presentation Graphics* creates attractive presentations with a module, called Presentation Master, that you can use to design and play back sequences of graphs and charts. You can store up to 49 charts within a specified sequence and adjust the time delays. The Practice Card feature lets you type notes or comments that correspond to the presentation. Since you can store charts in directories separate from Presentation Master, presentations are easy to organize and maintain.

To eliminate agonizing waits for output, *Harvard Presentation Graphics* offers three different output qualities: draft allows you to print quickly, standard produces higher quality but slowly, and high quality is used for your final draft. *Harvard Presentation Graphics* offers a more-than-respectable variety of output, including a VDI interface that allows output to the Polaroid Palette. You can also print or plot charts in four different sizes, but you can't specify their coordinates on the page.

In exchange for simplicity, *Harvard Presentation Graphics*, at times, trades off flexibility. It gives you a choice of five basic fonts with certain preformatted attributes and preselected text sizes. While you can specify fill, boldface, italic, or underline for text titles, you must go to the configuration menu to select a different font. You cannot mix fonts within a single graph. The program chopped the labels on my pie chart to unrecognizable bits because they couldn't fit my text line. The package lacks a symbol library and freeform drawing capabilities, and it provides

Harvard Presentation Graphics

All Areas

Sales

only a modicum of annotation capabilities.

Harvard Presentation Graphics is a good reminder that simple programs don't necessarily have to mean simple results. The charts are uniformly high in quality, and the list of included features reflects excellent taste and judgment. If you need a single, easy-to-use package for multiple charting purposes, I highly recommend *Harvard Presentation Graphics*.

—Robin Raskin

KeyChart

Softkey Software Products' *KeyChart* is a menu-driven business and scientific graphics program that gives users terrific control of chart layout and composition. *KeyChart's* preview feature makes the program stand out from the crowd. When you add its data importing method and other features, you have a very powerful and flexible graphics creation tool. At $375 for the plotter version and $149 for the dot matrix and laser printer version, *KeyChart* is not inexpensive, but it delivers full value for the price.

KeyChart's installation is automatically run from a batch file. The System Settings option on the main menu lets you step through screens to select your plotter (or printer with the printer version), video board and data path (disk drive and subdirectory). It's easy to reconfigure later on if you make changes.

You have a lot of control with *Key-Chart*, but for beginners it may appear that you have too many decisions to make. Before you start entering data in *KeyChart*, you are confronted with a "fixed screen," which you can fill with information about your chart. Actually you can rely on *Key-Chart's* default settings most of the time. All you really have to tell it is the number

of variables and the number of observations. Unfortunately, *KeyChart* gives the impression of being harder to use than it is.

KeyChart's user manual is very complete, if a bit dry. The overview tutorial is just that: a quick look at the major functions.

KeyChart passed *PC Magazine's* robustness tests just fine, never blowing away data or leaving the program as long as we corrected the offending error or hit the Esc key.

The program comes with sample charts that can be modified to fit your own data and needs. Because you can look at all the settings that created the sample charts, you can use those charts as models.

KeyChart is a powerful graphics tool that gives you lots of control. For instance, you can explode any or all of a pie chart's slices. You can also list data items as percentages. You can specify up to 99 floating titles and size and place them independently. The package drives a wide variety of printers, plotters, and film recorders, such as the HP 7510A used to output the image below.

KEYCHART PRESENTATION GRAPHICS
The Varied Sources of Income

and quagmires.

PC Pastimes.

The play's the thing.

For years, industry fuddie duddies have been trying to figure out the extraordinary attention of our industrious fuzzy wuzzahs. How, they ask themselves, did a bunch of small tree-climbing carnivorous mammals manage to metamorphose the miniature maildrop of Marlow, NH (pop. 545) into a micro mail-order monolith?

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We know it's no fun struggling late into the night with an obsolete program when you could be snuggling up to your favorite furry friend. Or tearing your hair out over some incomprehensible instal-

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Give your PC the bird—with *Hopper*. Together at last with *PC Man*, on one disk. Offer not available to net accounts. Limit one per customer.

For the IBM-PC (XT & AT) exclusively.

PREVIEWING YOUR CHARTS Perhaps the most impressive feature of *KeyChart* is its preview facility. Once you have told the program all you want to about your chart, you can select Preview from the main menu. You next see another menu from which you can choose one of three options: Full-Screen Preview, Full-out Preview, or Front Preview.

Full-screen preview shows at a glance what your draft chart looks like. If you don't like what you see, go to the layout preview, in which you can dynamically change the position and size of various items. The chart preview function is a great timesaver and a superb chart editing tool.

KeyChart will import data from some other programs directly. You can also create an ASCII text file with a word processor. Once the text file is created, you can use the F9 key (Load data from disk file) when creating charts. You then mark the beginning and end of the data you want to bring in, hit T for Transfer, and the data shows up in the designated part of your data table. You can use this process for loading anything from legends to floating titles to actual data points. This process works like a charm.

You can specify up to 99 floating titles for any chart. Floating titles can be sized and placed independently, or they can be locked to previous titles and be made to maintain their relative positioning, even if the first of a series of floating titles is moved around. Floating titles can also be used to create text charts or signs using *KeyChart*'s fonts and sizing capabilities.

KeyChart has a batch processing mode, in which you can specify multiple copies of one chart, multiple charts, or a mixture. To save time in printing or plotting frequently used charts, you can create a DOS batch file that tells *KeyChart* which charts and how many of each should be printed.

KeyChart includes logarithmic functions and multiple regression types. You can specify regression varieties at the time of entry or, more powerfully, while editing with the preview function. You can choose from linear regression, exponential regression, power regression, and logarithmic regression plottings to observe data relationships.

The program could stand a few improvements. The multitude of menus reduces the need to refer to the manual, but they also get in the way. I wish there were a way to go directly to a command mode and bypass the menus. A related issue is speed going from menu to menu: it's not bad with an 8-MHz AT, but it was noticeably slow with an 8088 processor. I'd also prefer to have one version work with both printers and plotters rather than have to buy two copies of the program.

KeyChart is a tremendous business and scientific graphics program. While its features may be more than you need if you create charts only occasionally, those who produce many charts and can use *KeyChart*'s dynamic editing ability are well advised to take a close look at this program.—*Bruce Brown*

Nimbus

Nimbus is a paradox. Its creators at Media Cybernetics clearly put careful design, clever programming, and many hours of work into developing the product—yet they seem to have blinked on some basic points. The program performs varied business graphics tasks, often with interesting added features, but these benefits don't make up for a general lack of polish and for some hidden flaws that seriously hamper the program's usefulness.

On the face of it, there's a lot to like about *Nimbus*. It does bar charts (including 3-D graphs), line graphs, pies, area graphs, scatter plots, and high-low diagrams. It can produce text charts, either free form or based on predefined formats. It also has 18 different available fonts, which you can make bolder if you choose.

Another useful extra is a data file editor that lets you duplicate data from one chart and save it as a set in another chart (or in the same chart). You can also combine data sets using addition, subtraction, multiplication, and division. This makes short work of creating complex analyses of related information sets.

Nimbus supports 22 different video graphics adapters, some of which I never even knew existed. It works with 16 different pointing devices, including keyboards, mice, trackballs, and digitizing pads. It also supports a handful of plotters, and it knows how to talk to laser printers, ink jet printers, and even the Apple Imagewriter.

So what's wrong? Plenty. Take data import. *Nimbus* accepts only data elements (no titles or headings) and only in .DIF or ASCII format. What's more, the ASCII format isn't very useful, since it requires nonstandard formatting. Yet the .DIF import has one dandy feature: you can "rotate" data to bring in the information by row or by column, no matter which way your spreadsheet was designed.

The data-import features point to a general problem with *Nimbus*: it does one or two things very well, then spoils it by failing at something simple. For example, you can type up to three lines of free-form text to be included on a chart, and you can indicate where you want them to appear. But you can't control the size of these letters (unlike almost every other instance of text on the chart), and the large size provided by the program will almost certainly obliterate part of your graph.

You can only print using as many colors as are available on your display screen, so if you're using a color/graphics adapter in highest resolution, you'll get only one col-

or on your printout. You can improve on this by using the Virtual Page feature (which requires 640K bytes), but that's not easy to figure out from the documentation. In fact, the configuration program defaults to not using the Virtual Page feature. Also, the program's text chart feature is a separate module, so if you want to include text chart material on the same page as your graph, you must print one first, reinsert the paper, and then print the other. Be sure to save your data before you switch; it won't stay in memory.

LITTLE FLAWS Nimbus has lots of other little flaws. You are supposed to move from field to field in the specification screens using the Tab and Return keys, but I found that the cursor control keys also work. You'd better not use them, however—they don't behave consistently, and once I hung up my keyboard by pressing them instead of the "proper" keys. In tests for robustness, the program generally relied on DOS to trap disk errors and performed acceptably on printer errors. An annoying surprise cropped up when I encountered a read error while printing a graph. In response to the DOS "Abort, Retry, Ignore" on-screen prompt, I pressed the R key. The DOS message appeared as part of the printout!

In a program full of weak links, the documentation is one of the weakest. More than a third of its 100 pages are single-screen shots of sample graphs or menus. The tutorial, a mere three pages long, is based on a single sample file that provides only a cursory introduction to some of the features. It offers no instruction on finding the menu for pie charts, which is hidden (I found it only by stumbling across it), and it says nothing about text charts at all. The reference section has no examples illustrating the effects of the different options. And to cap it off, there is no index.

It's hard to get worked up about a program like this. Nimbus does a fair job of printing adequate graphs, but its many flaws and restrictions make it a chore to use.—**Alfred Poor**

On the face of it, there's a lot to like about Nimbus, despite its burden of problems. It produces a wide variety of charts and allows you to put up to four of them on a single page. It has 18 fonts, which you can make bolder if you choose. And it supports a wide variety of adapters and output devices, including the HP 7510A image recorder used to create the pie chart below.
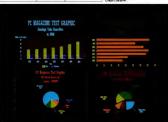
Perspective

Perspective, from Three D Graphics, is one of the most innovative packages to come along in years. It lets you create 32 kinds of three-dimensional graphs from data, each of which you can rotate on all three axes and view from 16 different angles. The package offers a wide array of two-dimensional graph types as well. Best of all, the package is very easy to use.

In the 3-D format, you have many options for dressing up your graphics. You can fill your screen with graphs, which you can size to fit any space. You can enlarge or reduce title and subtitle text, as well as

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Perspective's strong suit is 3-D graphics. The package lets you turn your data into 32 kinds of 3-D graphs, which you can dress up by resizing titles or dragging them around the screen. However, you can't make a 3-D pie chart, only bar and line graphs. The current version also limits you to printer and plotter output. The image below was printed with an HP Laserjet.

PERSPECTIVE

Millions of U.S. Dollars

Years

After-Tax Earnings

add boldface or slant it. You can choose from a mind-boggling assortment of 180 background patterns and fills. You can add borders and remove frames. And you can even drag 3-D titles around on the screen until they appear exactly where you want them to be.

Exciting as are *Perspective's* 3-D graphs from a design standpoint, however, they are limited in that they are all variations on line and bar chart formats.

The 2-D graphs include various line and bar charts, such as vertical and horizontal percent bars, vertical and horizontal bar clusters, stacked bars, and both absolute and relative multiple-line graphs. You can also make polar coordinate and relative stacked-area charts, absolute multiple-area charts, spectral mapped cell graphs, as well as single and multiple pie charts.

Unfortunately, the amount of customization you can do in a 2-D file is limited. You can't change fonts or move titles unless you combine 2-D and 3-D files on the same screen; to do this you freeze the first image on the screen using a menu option, then add the second file.

Output is also less than optimal. Until the color version comes along, you'll have to settle for black-and-white graphs printed on your dot matrix or HP Laserjet printer, although you do have the option to change print density and margins. There's no support for film recorders or plotters.

EASE AND ENJOYMENT Perspective is exceptionally easy to use. You can create graphs without ever reading the manual: simply choose the options listed on the screen. To access most of these choices, you use the first five function keys, which change tasks as you proceed through the program's menu levels. The F10 key switches these menu levels, and, if you've made changes to the graph, it redisplays the graph. Luckily, small representations of these keys labeled with their current function remain at the bottom of the screen at all times.

Installation is a matter of using a simple batch file that creates separate subdirectories on your hard disk for the program files, graph formats, data, and completed picture files. Error-trapping is excellent throughout the various operations.

Data entry and import are also accomplished with ease using the Data Manager screen. A small menu at the top of that screen allows you to specify cell coordinates for titles, row and column headings, data labels, and the data itself. In other words, you can select data to be graphed in ranges, much as you might from a *1-2-3* file. *Perspective* can import data in ASCII, .DIF, and .SYLK formats. And once you tell the program the name of the file you wish to import, *Perspective* automatically determines its type. It then imports not only the data, but also the title, subtitle, and column and row labels.

This is a fast, flexible program that can be run and enjoyed by any level of user. At $295, it's a bargain.—Marvin Bryan

PFS:Graph

Software Publishing Corp. has been a major contender in the microcomputer world since the early 1980s. The reason for its success? Primarily because its *PFS:* series meets the need for easy-to-use, practical programs. *PFS:Graph* is no exception.

For $140, you get a basic graphics program that's easy to learn and use. *PFS:Graph's* simple menus offer clear one-step choices of the program's most significant functions and features.

In fact, if you've used other *PFS:* programs, you'll feel right at home. The F10

key continues a process, and the Esc key takes you back to the main menu, as in the other packages in the series, which use same control keys.
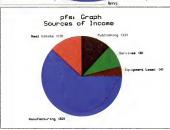
You can use *PFS:Graph* to build bar, line, and pie charts. You can also modify the basic formats somewhat to create area charts and stacked bar charts. *PFS:Graph* also allows you to mix bar and line graphs in the same chart. Bar charts are limited to 36 data points, and pie charts can have no more than eight segments. You cannot explode pie segments.

To create charts, you can enter new data or import data from other programs, including those that either use or can export files in .SYLK or .DIF formats. In addition, you can easily use data from *PFS:File* or *PFS:Plan*, and you can send a graph to be incorporated into a *PFS:Write* document. Once your data is in *PFS:Graph*—either imported data or data entered in *PFS:Graph* itself—it's easy to go back and forth between the data table and the graph display to make changes to the data and to view the results of the changes in the graphs.

Entering data, labels, titles, and legends is easy. One particularly useful feature is a selection of four formats for displaying dates by day, month, quarter, or year. When you have created a graph, you can save either the whole chart with all its

If you've ever used another PFS: series package, you'll feel right at home with PFS:Graph. It lets you build basic bar, line, and pie charts plus a few extras like area charts and stacked bar charts. You have a choice of colors, shades, or hatching patterns to differentiate between data items. You can output to printers and plotters (used to create the output shown here).

pfs: Graph
Sources of Income

Real Estate (13)   Publishing (12)

Services (8)

Equipment Lease (4)

Manufacturing (62)
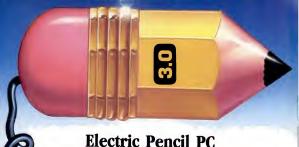
data and other settings or save just the screen image as a picture file, which you can call up for later printing or display. You cannot then modify the picture file further, but if you save the whole chart with its settings, you can change data or other settings later. The *PFS:Graph* Get/Save/Remove menu screen shows filenames in an indicated subdirectory—a very convenient facility when you want to save a new file and don't remember the names of current files on the disk.

CRASH-PROOF The program is virtually indestructible: Nothing crashes it, despite all the nasty tricks I tried. Unfortunately, though, *PFS:Graph* is still copy

protected. Software Publishing Corp. has removed copy protection from the rest of its older product line and also from its new releases, but the *PFS:* series still limits you to one floppy disk backup and five hard disk drive installations.

Software Publishing Corp. has long had the reputation for clear, instructive manuals. The documentation for *PFS:Graph* is no exception. The manual leads you through processes screen by screen in a combination tutorial and reference format.

PFS:Graph is best suited for those with limited needs for simple graphics who want a product that can give them what they need—without a steep learning curve, price tag, and work load.—Bruce Brown

Picture Perfect

Picture Perfect, from Computer Support Corp., is one of those wonderful programs that are easy to start with and difficult to outgrow. If you need to create basic charts and graphs, *Picture Perfect* will accommodate you, making your job fairly easy in the process. On the other hand, if you need to create complex graphs that present difficult problems other packages can't cope with, *Picture Perfect* will work just as well, and just as easily.

The program is really a collection of five separate modules, each of which handles a different type of graph: vertical bar, horizontal bar, pie chart, line, and combined bar-line. With all the options within these categories, you're sure to find a format that will present your data in its best light.

Switching among modules is a little awkward; the loading delays will discourage you from changing back and forth too often. You can read data from one chart format to another, however, and so transforming a bar graph to a line graph is not difficult.

All modules use a consistent command and menu structure. You use the first eight function keys to make selections from the menu, and the options are consistently displayed at the bottom on the screen in eight highlighted boxes. Some selections call up other submenus, some execute commands, and some toggle different features off and on. For example, you use a function key to direct the plot to a printer or a plotter. Another function lets you route the data to a disk file instead, so that you can print the files later using a batch file.

THE CUSTOM TOUCH You can use the system defaults to design your chart, or you can take control of every little detail. *Picture Perfect* gives you a choice of 13 different typefaces (with more available as an option) and normal or boldface print. These characters are based on shape definitions instead of bit-mapped images, and you can enlarge or reduce them at will; you specify how large the largest type should be, and how small the smallest type should be, and *Picture Perfect* adjusts the intermediate sizes accordingly.

The program gives you a choice of 54 different shading patterns, plus 3 extra ones for pie charts based on radial and circular lines. You specify which pen will be used to plot the sections; if your plotter has fewer pens, *Picture Perfect* will stop and ask you to change the pens.

Axis scales are sized automatically, but
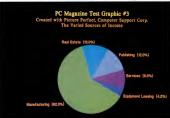
Picture Perfect gives you a wide range of options for customizing your graphs. For instance, you can reduce or enlarge type sizes; the program gives you a choice of 54 shading patterns, plus 3 extra ones especially for pie charts; and you can float text anywhere. The package has drivers for printers, plotters, and image recorders. The chart below was output using the HP 7510A image recorder.

PC Magazine Test Graphic #3
Created with Picture Perfect, Computer Support Corp.
The Varied Sources of Income

Real Estate (13.0%)
Publishing (12.0%)
Services (9.0%)
Equipment Leasing (4.0%)
Manufacturing (62.0%)

you can override the setting if you want. You
if a bar exceeds the top limit, the plot
"breaks" the bar to show you the prob-
lem. You can control the placement of the
bar values: in a window in the bar, on top,
at the bottom, or not at all. You can also
have two different y-axis scales and speci-
fy which bars are to be plotted against the
left or the right.

> If you must
> create complex
> graphs that
> present
> problems other
> packages can't
> cope with,
> Picture
> Perfect will
> accommodate
> you.

Picture Perfect goes even further in
helping you customize your graphs. You
can put up to nine free-floating blocks of
text anywhere you wish on the chart. Ty-
pographic "bullets" can readily make
your lists more attractive. (If you wanted
to, you could probably make some fancy
text charts just by using these blocks and
not showing the graphs.)

Picture Perfect cannot put two graphs
on the same screen, except through the use
of the Bar-Line option. You do have total
control, however, of the size and the place-
ment of a graph on the paper. As a result,
you can put many different types of graphs
on a page.

My major complaint is that the program
is copy protected and you must use a key
disk. You can install (and uninstall) it on a
hard disk, though, and then use the manag-
ing program to search all available disk
drives for *Picture Perfect* modules, so you
can spread your modules over different
subdirectories and disk drives if you wish.

Another possible drawback is that the
program can be fairly slow while plotting
the graph to the screen because it must cal-
culate everything, including the individual
text characters. You can forgive the delay

once you see the detail and precision that
all this work. Fortunately, you
can also speed up performance significant-
ly by using a math coprocessor (8087 for
PCs or XTs, 80287 for ATs).

Picture Perfect's manual is more of a
tutorial for each section than a reference,
but the program's user interface is so con-
venient that you really don't need to con-
sult a reference too often. If you have any
question about a menu choice or option,
you can simply press the F7 key and get a
full screen of detailed, context-sensitive
help. The manual lists all the menu options
and the different shading options that are
available, which are handy to have as a
quick reference. The program also in-
cludes sample files handy for learning
more about the range of capabilities.

If you need to produce serious graphs of
professional quality, then give *Picture
Perfect* a good long look. It has all the
power you'll need, whether you're buying
your first graphics package or a replace-
ment for one that you've outgrown.
—Alfred Poor

Slide Expert

Slide Expert, as you might guess, is a busi-
ness graphics package that produces
35mm color slides. It's simple: you use the
program to design your charts, then you
send the files via modem to one of five Au-
tographix imaging centers. They will re-
turn high-resolution, professional-quality
slides or 8- by 10-inch transparencies with-
in 1 day.

The graphs you can create are restricted
to a number of predefined formats, includ-
ing pie, bar, line, and area charts, although
a "custom" chart option allows more de-
sign freedom. Other formats are used to
create word and tabular charts. When
you're entering data, an on-screen diagram
serves to remind you of the names of the
components used in each graph style, and
where they will be placed. For example,
when you're creating a line graph, the dia-
gram shows each axis and indicates how
the final image will display titles, labels,
and legends.

A set of glossy color "guidelines" in-
cluded with the program ensures that slides
will have a harmonious palette. And a sec-
tion of the manual is devoted specifically

to good design techniques. Although you
can always find a way to make a mess of
your graphics designs, *Slide Expert* does
its best to keep your graphics pleasing to
the eye.

Slide Expert is menu driven and easy to
use, with help windows on the screen most
of the time. The menus lead you through
the steps needed to create a chart from text
or numbers. The easiest way to create *Slide
Expert* graphs is by keying in data, titles,
and labels.

CONVOLUTED CONVERSION Al-
though the package includes a module to
convert *1-2-3* and *Symphony* data, the pro-
cess is convoluted. You must first load the
1-2-3 software, then retrieve a special Au-
tographix worksheet that comes with the
program. You must fill in this worksheet
with your data, either by typing it in or
through the use of formulas that access
other areas of the worksheet. The resulting
worksheet is saved to disk and is now in a
format that *Slide Expert* can read.

No matter which procedure you enter
data with, you can edit the basic compo-

Slide Expert allows you to design charts on your PC, then send the files via modem to one of five Autographix imaging centers, which is how the slide below was created. The center used a Celco R5000 image recorder. You can make a printout to preview your charts, but the package does not support plotters. A nice extra is that the documentation provides tips on color selection and design.

nents of graphs to some degree. Editing involves making a series of menu choices and typing in changes when prompted. When all changes are complete, *Slide Expert* redraws the image on the screen. You can modify the text of labels, legends, and titles, as well as alter numeric data. However, your ability to move or resize these individual elements relative to each other is restricted.

A chart type called "custom" is the only one that allows you to enter and reposition lines, rectangles, and text freely. You can add symbols from the library, which includes a variety of borders, maps, and backgrounds, to existing charts, but you cannot alter or scale them. Several

charts, including custom charts, can be combined into one image through use of the editing facility.

Slide Expert does not work with pen plotters, but it will send output to most popular dot matrix printers, as well as to the HP Laserjet. Printer output is primarily intended for previewing an image. The monitor is just a guide to what the finished film image will look like. On the screen, images are displayed in CGA resolution, with only four colors. Text may be represented simply by a rectangle if it is too small to be distinguished properly at the relatively low screen resolution.

Keep in mind that *Slide Expert* is intended as an interface to the five Autogra-

phix imaging centers, which produce extremely high resolution slides and transparencies with a wide range of colors. After you've created and approved your graphs, you transmit them to one of the imaging centers, using the included communications module and a modem. The communications software is very simple to use. You enter shipping and credit card information, as well as a list of desired image files off-line. Then you press a key and the program dials an imaging center, sends all the necessary data, and then hangs up the phone.

The normal turnaround time for slides is 1 day. Converting a file to either a slide or a full-color overhead transparency costs about $10.

Autographix's documentation is well structured; it is geared to the novice user. Most of the program's features are covered in a tutorial-style chapter called "Learning." To make it easier to visualize what the finished, full-color slide will look like, the manual shows high-quality color and style samples. Color reproductions of the library of 72 predefined symbols are also included.

Slide Expert is appropriate for your business if you require top-quality presentation graphics but cannot invest in expensive output equipment, especially if your need for slide production is minimal or sporadic, or a trained graphics staff is nonexistent. (If your graphics needs grow, Autographix can provide full-function workstations and a networking version of its software called *AGX 35*, which costs $895 per copy.) *Slide Expert* is also well suited to users who might be unsure of their artistic abilities and who would welcome the many predefined graph formats and color schemes. The user who sticks to *Slide Expert*'s suggestions is likely to produce the most successful images.

—David Hoffman

●●

SlideWrite Plus

Load up Advanced Graphics Software's *SlideWrite Plus* from its two unprotected disks, fill out the configuration screen, and you are on your way. Like a pair of prewashed jeans, the program is a comfortable fit; you ease into creating whatever charts and graphs you want. *SlideWrite*

SlideWrite Plus gives you a sufficient rather than a generous store of options for creating handsome charts with little difficulty. For instance, you can use pictographs to add punch to a standard pie chart and shade or color them for additional impact. You can also size images to fit a given space. The chart below was output using an HP 7510A image recorder. You can also produce printed or plotted output.

Plus has some minor limitations, but for
most intermediate-level users, its features
justify its $345 price tag.

One of *SlideWrite Plus's* best qualities
is its ease of use. It's menu driven, using
the first eight function keys, and you may
not have to refer to the manual at all once
you complete the 30-page tutorial. All
available options appear in highlighted
blocks at the bottom of the screen. A number of the submenu options are toggle settings, with their status shown below the label. In instances in which you have many
choices available, such as storing or recalling a file, a touch of a key brings a directory listing to the screen, making it easier to
enter your selection.

Data entry is smooth and easy. *SlideWrite Plus* lets you input a range of dates
simply by entering the first in the series.
You can specify the *x* axis as either a set of
discrete elements (such as years or products) or as a numeric range. Viewing the
same data in different graph formats is
simple enough to do—just change one option and look at the results. The program
offers the usual mix of graph designs: horizontal and vertical bars, stacked bars, line,
area, scatter, high-low, and pie (any or all
of whose wedges can be exploded). You
can also mix bar, line, and scatter graphs
on a single chart, although you cannot

place more than one chart on a single printout.

SlideWrite Plus offers only five different fonts, but they are clean, attractive, and
available in either roman or italic. You
have complete control over shading and
colors of the different elements of the
charts. Although you don't get many options to choose from, you get more than
enough to create a handsome chart with
very little difficulty.

WORTHWHILE TOOL A few extra
features turn this acceptable program into a
worthwhile business tool. The text chart
module lets you create "word charts"
signs for presentations. It can also auto-

matically expand or reduce the text for optimum fit. With a draw module, you can
create lines freehand on the screen and add
both text and predefined figures to your
chart or graph. The figures include shadowed and drop-shadowed boxes, circles,
flowchart shapes, circuit diagram elements, and pictographs of people and objects. You can quickly dress up a simple
graph, create a flowchart, or develop an
organization diagram.

SlideWrite Plus even addresses one of
the most annoying problems of graphics
programs, the length of time needed for
printing the results. With *SlideWrite Plus*,
you can "batch" the output procedure.
First, you create the images that you want

and save them to the disk. Then, you call up a batch process screen, enter the names of the images to print or plot, start it, and walk away. If you're plotting, you'll still have to change paper pad, perhaps, pens, but you won't have to keep entering the names of the files to plot. And, should something go wrong, as happened on the last two entries on one of my print runs, it's

SlideWrite Plus is easy to use. It's menu driven, and you may not have to refer to the manual at all once you complete the tutorial.

easy to eliminate the names of the files that went correctly and reprint only the ones that failed.

SlideWrite Plus does have some weak points, most notably in its data import. It promises *1-2-3* import, but actually it can bring in only a worksheet that already has a graph defined in it. The ASCII import, too, has fairly restrictive expectations about the format of the import file data. (Advanced Graphics is now shipping *SlideWrite Plus*, Version 1.1, which provides more flexibility in data import by reading *1-2-3* and *Symphony* spreadsheets and using the data directly, but we were unable to test this feature.) Other limitations of this program include the absence of dual vertical axes and 3-D bars. And in our tests for robustness, *SlideWrite Plus* trailed some other packages. Occasionally it would get hung up when it encountered printer problems.

For most users, however, *SlideWrite Plus*'s shortcomings will seem minor. The program is easy to use, has sufficient power for most graphics needs, and comes with many features to add zip to your presentations. It's an attractive choice.

—**Alfred Poor**

CONSTANT
COMMITMENT

THE
ENGINE

1-2-3

HAL

REPORT WRITER

FREELANCE

GRAPH WRITER

THE 1-2-3
SYSTEM

Energraphics

Energraphics, from Enertronics Research, is a top-class business graphics program. It allows you to easily import existing .DIF files and provides a wide choice of graph types along with a reasonable selection of colors, type fonts, symbols, and other illustrative material.

You enter the program through the opening menu, which gives you a choice of four functions: Graph, Draw, Support, and Utilities. The first is, as you might suspect, the main graphing program; the second is a drawing utility which, unfortunately, is not attached in any way to Graph; the third enables you to convert .DIF files into *Energraphics*'s format; and Utilities governs your hardware configuration.
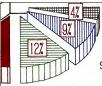
I started liking *Energraphics* as soon as I hit its data import facility. Unlike many similar programs that make the process as difficult as possible, *Energraphics* not only makes the data import easy, it gives you the opportunity to monitor and alter your data several times during the importing process. For example, once the program has read your .DIF file, it shows you a copy of the spreadsheet so that you can choose the data you want included in your new file.

Once in the Graph module, you find your way through *Energraphics*'s various options by means of a helpful series of menus that appear on the upper-right-hand corner of the screen. Separate functions allow you to save a chart, read a previously created chart into memory, draw a chart on-screen or on paper, or create a totally new graphic.

EDIT SCREENS *Energraphics* sets up its graphics using a series of three "fill-in" edit screens, most of which have preset default values. The first is Create/Edit Data, which allows you to choose a chart type, then accepts your data along with identifying legends and data labels (if you have picked up the data from a .DIF file, it will

appear here). Create/Edit Scales allows you to determine the scale values and, in the case of bar charts, the labels for the horizontal and vertical axes. Create/Edit Text then creates room for a three-line title and one line for a copyright or other identification for the graph on the lower-right-hand corner of the illustration. Incidentally, you can also access all of these screens from your menu.

Once all your basic data is in place, you can then choose the Draw Chart option. Here, you choose such options as resolution, frame type, two or three dimensions, scoring, multiple or stack bars, overlapping, horizontal or vertical, numbered axis, display value, and chart size. Once you have selected all of these factors, the

The pie chart below was output using the Video Show 160 presentation system. If you want an elaborate presentation, your graph's colors and text fonts; you can also add text, frames, and any of 99 prestored images. However, while Energraphics *comes with a drawing program that you can use for creating illustrations, you cannot use this drawing facility to dress up your graphs.*

ENERGRAPHICS 2.0
The Varied Sources of Income

Equipment
Leasing

Services

Real Estate

program will draw the chart on-screen.

If you want a more elaborate presentation, the *Energraphics Customize Graphics* option lets you change your graph's colors and text fonts; you can also add text, frames, and any of 99 prestored images. Your chart is exhibited on-screen and each separate item is accompanied on-screen by a small yellow box; by placing your cursor in the box and "picking up" that item, you can then alter and/or move most of the chart's elements.

Energraphics allows you to merge up to four graphs onto one chart through a separate function that links them together in the on-screen format that you specify. You cannot customize a "merged" chart; if you want any extra text for your merged charts, you must create it as a separate "text chart." However, if you go back and change one of the original charts, those changes will appear in the merged product.

Unfortunately, the charting package does not take advantage of one of the program's nicest features: its Draw facility. This is a basic drawing program that you can use to create illustrations; however, any graphics that you create in the Draw program cannot be accessed by the Graph function, and vice versa. The only time you can use Draw to decorate a graph is when you alter a preexisting symbol in their shared symbol library—you cannot create a totally new symbol.

However, one problem does not bad software make. *Energraphics* as it now stands is an excellent graphics program; if the graphics and drawing facilities are ever linked, the package will be hard to beat.—**Barbara Krasnoff**

The Gallery Collection

The Gallery Collection, from Hewlett-Packard Co., is a good choice for the corporate computing professional who seeks a set of predesigned but highly flexible chart formats—and who has a lot of time on his hands. Though its menu-driven interface should be simple to use and though it can give you beautiful results, you won't master this program through intuition, quick-reference guides, or help screens. A combination screen/manual tutorial walks you through the basics, but no further. For the rest, go to the reference manual.

The collection consists of a straight graphics program and a drawing accessory. The graphics segment, *Charting Gallery*, is three separate programs for bar, line, and pie charts, each with its own set of menus to learn. There is no command line; all options are in the menus, which are accessed through function keys. While this means you don't have to memorize any commands, you do have to memorize how to find them—there are 67 command options on 12 menus for bar charts alone. To make a chart, you must travel through a network of unintuitive and easily forgotten function key paths. I found myself constantly relearning the program.
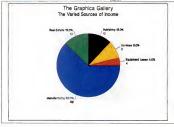
I can't think of any program as complex and involving as *Charting Gallery* that of-

fers no form of on-screen help—except *Charting Gallery*. In most cases, the prompt line tells you what to do next. If you get stuck in the middle of an operation, however, you must either experiment, turn to the reference manual, or call technical support. At one point, I blanked out the subtitle for one of my charts and could find no menu selection to bring it back. I couldn't even highlight the subtitle area, although I had done so earlier. After a long quest through the reference manual, I stumbled onto an answer. I had changed the size of the screen text to large, the only size that won't allow a subtitle. Changing the size back to medium solved the problem. Fine—but a help message might have saved me an hour.

The Gallery Collection consists of two programs. A straight graphics program called the Charting Gallery and a drawing accessory. The graph below was created with the graphics program and output using a HP 7510A image recorder. The charting program offers predesigned but flexible chart formats. However, it is very complex to use. The package includes three separate programs for bar, line, and pie charts, and each has its own set of menus to learn.

The Graphics Gallery
The Varied Sources of Income

Real Estate 13.0%

Publishing 12.0%

Services 9.0%

Equipment Lease 4.0%

Manufacturing 62.0%

These problems are vexing because the rest of *Charting Gallery* is rather easy to use. Data entry, whether direct or imported, is simple. The program imports ASCII and DIF files, as well as *1-2-3* and *Symphony* worksheets, straight into their proper boxes and columns on the data entry worksheet screen. You don't have to convert the Lotus files first; just hit the function key for Get Worksheet and you're ready to graph your numbers. Databases such as *dBASE III* or *Multiplan*, however, must first be converted into ASCII or .DIF files.

Installation and configuration also come easily; a wonderfully clear set of colorful screens guides you through every step. To select a driver, you simply move the cursor through a list of choices, pressing a function key to install your highlighted choice. Once the drivers are installed, the choices appear when you want to print. Bravo, HP, for making the configuration process so simple!

Charting Gallery recovers extremely well from errors such as an open disk drive door, a full disk, a nonexistent file, and so on. In all my testing, the program never got hung up. This time, credit goes partly

To make a chart with Gallery Collection, you must travel through a network of unintuitive and easily forgotten function key paths.

to the menu-driven interface. If you haven't installed a plotter driver, for example, the name of the plotter won't appear on the function-key menu for output. There's no way to pick the wrong device.

The documentation, although of professional quality, is generous with reference material but stingy on the tutorial side. Still, the well-written reference manual spells out most charting operations in detail. Vendor support for the product appears to be excellent.

SPRUCING UP *Charting Gallery* contains a wealth of special features, including a handy file-manager screen. The most special feature of all, however, is *Drawing Gallery*, included for freehand graphics production and for sprucing up the appearance of your charts. *Drawing Gallery* gives access to many text enhancements regarding fonts, type size, and placement. With it, you can create organizational maps, flowcharts, diagrams, schedules, and forms. And you can get rather fancy, adding thematic graphics, lines, arrows, boxes, symbols, shapes, text, and much more to your charts. More than 600 images come with the basic package; additional portfolios, each with about 200 to 300 images, cost an average of $95 apiece.

The Gallery Collection lists for $695, largely due to the inclusion of *Drawing Gallery*. For high-end users, that price certainly represents a value, but anyone interested only in basic graphics might want to consider *Charting Gallery* alone, priced at $295.

Overall, *The Gallery Collection* is very

powerful software with the potential for beautiful results. Unfortunately, getting to those results is no simple task. If the excessive menus and their awkwardly placed selections could be rearranged, I would not hesitate to recommend this package for high-end applications—even for beginners. As it is, you will have to work hard to master this package.—**Phil Wiswell**

GrafTalk

You can get anything you want with Software Solutions' *GrafTalk*, but you may have to work at it. Dual *y*-axis graphs, text charts, free-floating text, scatter charts with regression lines, and a host of other basic and exotic features make *GrafTalk* a serious program for those willing to spend the time required to master its intricacies.

The program has been around for quite a number of years and is now in its fourth major release. Originally published by the Redding Group, it was recently acquired by Software Solutions, publishers of the database program *DataEase*. According to company representatives, Software Solutions is working on a new version of the program that promises to retain many of the original capabilities while improving the user interface. Since it is due out at about the time this review should appear in

print, you may want to check out the new version if this one has the kind of features that interest you.

And *GrafTalk* does have many features. It starts off with many of the basics: bar charts (horizontal, vertical, clustered, and stacked), pie charts, line charts, scatter charts, high-low graphs, and area charts. It then goes on to offer some more unusual options. Bubble charts allow you to compare quantities (one as an absolute and the other as a relative measure) for a number of observations. *GrafTalk* also offers regression lines and table charts that show your data. You can position your bottom *x* axis at any value on the *y* axis you choose, and you can set up different left and right *y*-axis scales.

GrafTalk also produces text charts. Its sketch feature enables you to draw geometric shapes and freehand lines, so you can create drawings and organization charts. Twelve different fonts are available, and you can size each to suit your needs, plus choose either roman or italic style. You can send the text in any direction, including angles. Also, *GrafTalk* lets you combine different types of charts on a single plot. There is a slide-show feature in the program. The subtitle on this graph is free-floating text; you can even create custom menus and prompts.

The program produces fairly attractive graphs quickly. It plotted fast in our test with an HP 7470A, and the characters it produced were a little angular but acceptable.

GrafTalk gives you control over a wide range of graphic design elements, but there can be complicated to master. Fortunately, the program can create acceptable graphs like the one shown below using the default settings. The subtitle on this graph is free-floating text; you can control its size, font, and placement.

Pie Chart: GrafTalk
The Varied Sources of Income

- Manufacturing
- Services
- Real Estate
- Equipment Leasing
- Publishing

A GRAPHING PROGRAM LANGUAGE
GrafTalk in its elemental form is really a graphing program language. You create graphs by defining data sets and then stringing together a series of commands to define the graph. These commands may be issued at a *dBASE*-like .DO prompt or stored in a command file for execution. For example, here is the command file to create a basic pie chart with just a title, percent labels for the segments (a default setting), and a legend

```
@DATA
1 2 3 4
@END
TITLE "A Pie Chart"
LEGEND AUTO "TV= "Mags"
      "News" "BBoards"
PLOT PIE R1
```

A simple area chart can require a command file of 30 lines or more. *GrafTalk* includes a simple editor that you use to create the command files, but it is not much like any popular editor and takes some getting used to before you can become proficient in its use.

GrafTalk's problem is its user-intimidating interface. How intimidating is it? Before you even get to the four distribution disks, you encounter a mass of documentation: three small pamphlets, a thicker booklet, and three thick wire-bound manuals. The primer booklet shows you how to start the program and draw a simple graph using the three different modes. You then turn to the Sampler to see a series of graphs and a description of how they were created, or to the Reader, which provides a topical overview of the different *GrafTalk* features, or to the Encyclopedia, a reference manual of the 160 (yes, 160) different commands in alphabetical order.

Fortunately, *GrafTalk*'s makers took pity on its users and created not one, but two different front ends to the command-driven system. Its menu mode lets you select options for different types of operations, such as entering data, setting legends and titles, and choosing the plotting device. This option limits access to only some of the program's power.

The prompt mode, on the other hand, asks you a series of questions about the graph you wish to create and then draws it for you. You then have the option of

changing the settings, which leads you to a menu that is similar but not identical to the menu mode menu. I found *GrafTalk* easiest to use with the prompt mode, but I still had to "duck out" and use the command line to perform some operations, such as deleting rows or columns from my data sets.

GrafTalk is weak in data import: it will import *1-2-3* data from worksheet files but not titles or axis labels. Also, it doesn't show much intelligence in its use of pens on a two-pen plotter. It will prompt you to switch pens as needed, but it will require you to run through all the required pens twice since it prints the entire graph before it prints any of the legend.

The program has poor prompts and error-trapping, too. When entering legend captions arranged in a vertical list on the

Impressionist does have the features necessary to create complex, superb-looking charts, but mastering this program is a nightmare.

screen, for example, it prompts you to press cursor keys to move from field to field. The Cursor Down key would seem to be a logical choice, but instead it behaves erratically. You must either press Enter twice or use the Cursor Right key to move to the next caption field. When I entered a long title for a graph and then tried to draw the graph, I was told that there was not enough room to print a legend caption. I tried using smaller type for the legends, but that did not help. When I removed the legends entirely, I was told that "6" was too long to plot on the graph. These redherring error messages never referred to the graph title itself, and the problem went away as soon as I shortened it. And *GrafTalk* is a somewhat fragile program, rely-

ing on DOS to trap some disk errors.

Customer support is good, though, which is unusual for newly acquired products. And the person I spoke to was knowledgeable about the quirks and pitfalls you might encounter when using the program.

Overall, *GrafTalk*'s many powerful features make it interesting, but they still don't balance out its intimidating interface and its documentation problems. If Software Solutions made *GrafTalk* easy to use (like its *DataEase*, which has a more-driven interface), then the program might well be worth considering. My advice: wait for the new release.—**Alfred Poor**

Graphics Express

There's more to *Graphics Express*, from Bell & Howell Co., than meets the eye. Behind the friendly-looking opening menu hides a mammoth program that supports digitizing tables and sophisticated output hardware; it also offers powerful features for generating and customizing almost any kind of business graph or word chart.

The package is based on a Zenographics program called *Mirage*, which was first copyrighted in 1981. One of the primary purposes of the Bell & Howell version is to offer support for its own $6,000 film recorder, the Color Digital Imager IV. The program retails for $1,200 and is appropriate for the corporate heavy user who wants control over a variety of output devices and has at least one expert on staff to supervise the use of more-advanced features.

Graphics Express will import ASCII, .DIF, and .SYLK files. The only major type of graph it cannot generate is the organization chart.

Although *Graphics Express* can run on a floppy disk system, you'd have to do too much disk swapping with this 1.8-megabyte program to make that very practical. The copy-protected program requires a key disk to load, and installation is easiest if you intend to use the Bell & Howell default list of equipment. This list, of course, includes the company's $6,000 film recorder, but also less-exotic hardware such as the Hewlett-Packard two-pen plotter and Epson printers. You must later enter any deviations from the automatic assignments made in the installation batch file in-

dividually as DOS command lines. Here you can specify devices such as the Video Show 160 and the Polaroid Palette, also thermal, ink jet, and laser printers.

The opening menu, labeled Level 1, has nonthreatening options like Make a Graph and Tutorials. However, Level 2 has layer upon layer of menus intended for experienced computer users, as well as a command language. To access this level by pressing Shift-F8, an option that does not appear on the Level 1 menu. The theory is to shield novices or occasional users from the complicated features but permit them to create simple graphs. The result in Level 1 is, for example, that you can add a main title to a graph but not a subtitle.

PROGRAM STRUCTURE An intricate program structure has its advantages. In Level 2 you can plot mutiple graphs on the same page, display three axes on a bar chart, display different scales if you like, perform linear regression, show negative values in a different color, and even maintain a database. You can select most functions

by choosing options by number from the menus. Many of the problems for the beginner arise from lack of understanding of how the options interrelate. For example, you can't use lines connecting external percentage labels to applicable slices of a pie without also turning off the legend box display; this action causes both slice labels and percentages to be shown adjacent to the slices—with connecting lines if you want them.

The size of graph files is not a problem. The package uses virtual memory and swaps to disk any portion of a file it can't hold in RAM. Not all aspects of a graph are easily controllable, though. You can specify the color for the first slice of a pie; the program will then select the others,

based on algorithms of its own.

Lessons on paper plus interactive tutorials and help screens assist you in learning the software. The manual is large and adequate, but it does have some minor errors and omissions. Telephone technical support is free. One-day training classes are available in Los Angeles and Chicago for a $250 charge.

Neither the menu structure nor the command language are awkward for the seasoned user. And the program is well behaved, unless you try printing to a device that's not on-line. Then it will freeze up without a warning message, and you'll have to reboot your system.

If you have an 8087 or 80287 math coprocessor chip, you'll be able to calculate

and plot to the screen at a remarkable speed even on an XT—in something like a couple of seconds for most images. Without the chip, redrawing a detailed screen could take as much as a long minute or more, even on an XT. If you can afford the fare and have elaborate graphing needs, however, *Graphics Express* can get you there.
—Marvin Bryan

Impressionist

Impressionist, from Execucom Systems Corp., is a powerful business graphics program that was designed 5 years ago for mainframe computers. It seems to have been ported directly to the PC rather than redesigned for the PC, so the user is faced with what can only be described as a user-hostile interface. *Impressionist* does have the features necessary to create complex, superb-looking charts, but mastering this program is a nightmare. The menu forces you to learn a new vocabulary of charting terms; it provides no useful prompts. On-line help is not as helpful as this complex program demands; the two oversized manuals are neither clear nor organized; and at least half a dozen times during my testing the program froze the keyboard or dumped me out to DOS. *Impressionist* may be one of the worst-designed pieces of high-end software ever released for personal computers.

The big question concerning *Impressionist* is this: Who is the appropriate user? It's menu driven, so you might suppose *Impressionist* is designed for the average businessperson—until you try to learn it. The menus consist of one- or two-word choices that usually do not provide enough clues to their meanings.

The methodology behind building, displaying, and printing, or plotting a chart is just as confusing as the menu terminology. Data entry and editing is clumsy. *Impressionist* uses no worksheet or arrangement of rows and columns for data entry; instead, you first set up the type of data you wish to enter, then type the data as a list. To edit, you must give the program the number of the series you wish to change.

For example, to create a bar chart of two variables across 6 monthly periods, you first select Curves from the menu (no, I don't know what the name has to do with

Although Graphics Express supports a number of output devices, one of the package's primary purposes is to offer support for Bell & Howell's own film recorder, the Color Digital Imager IV, with which the image below was output. The package creates all the major chart types, except organizational charts. It operates using an intricate two-level program structure designed to provide powerful features for advanced users while protecting novices.

Graphics Express
How Income will Change with the merger

Manufacturing 38.8%

Real Estate 19.4%

Publishing 11.2%
Services 6.1%

Equipment Leasing 24.5%

PROBLEM: Handling your need for more megabytes, without spending megabucks on a new drive.

THE SOFTLOGIC SOLUTION: Cubit™

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Now get up to twice the capacity from all your storage media.

You know what happens. The more you use your computer, the more information you create. And the faster you fill up your disk.

The 10MB drive that once seemed enormous is now jammed with important files. That 20MB that should have lasted years is crowded in a matter of months.

Of course you could keep buying bigger hard drives.

Or you could get Cubit and get the maximum storage space from the drives you already have.

What is Cubit?

In brief, Cubit is an advanced software tool that automatically reduces the number of bytes required to store a file, then converts the file back to its original size when retrieved. Some programmers call this effect "data compression," others, "disk expansion." Either way, the result is the same.

Here's how it works. When Cubit compresses a file, it first compares each word to its massive English word dictionary. Words that match are reduced to a predetermined code of just one, two or three bytes each. It then saves the abbreviated version to disk. Decompression works just the opposite.

To accommodate other words and symbols, Cubit uses two more compression techniques. One assigns new, shorter codes to unusual words. Another compresses according to the frequency of character strings in non-text data. So no matter what kind of files you create, Cubit ensures maximum space savings.

Best of all, you'll be using the same fast, reliable data compression techniques used on mainframe computers for decades.

How much disk space will you save?

Because the vast majority of data created on PCs is standard ASCII text—letters, numbers and other English language symbols—we've optimized Cubit for word processing and database files. With these, you'll get a minimum of 50% expansion on up to a full 100% or more.

At the same time, you can expect a significant 30% to 50% improvement with other kinds of data. Including spreadsheet files, program code, graph and image files, even binary data.

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With Cubit, you'll get up to 100% compression on data files, effectively doubling the storage capacity of all your magnetic media.

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Cubit is already saving time, trouble and money for thousands of PC users nationwide – by giving them up to twice the storage capacity from all their magnetic media. And all for just $49.95* – a mere fraction of the cost and bother that come with a bigger hard drive.

Look for Cubit at better computer dealers everywhere. Or order from SoftLogic Solutions by calling 800-272-9900 (603-627-9900 in NH). Or mail the coupon below.

bar charts, either) and then type 2-3. This signifies that you will be using two variables in the series. It is a rule that your first variable cannot be the number 1. Then you must select Points from the menu and type 1-6. This signifies that you will be using six data points in the chart—in other words, bars for January through June. After this is set, you may select Enter Data, and the program will prompt you to enter the 12 pieces of data in a list. If this sounds clear so far, you should rush out and buy *Impressionist*—it's your kind of program.

Installation is simple and automatic, with little room for error. It takes about 15 minutes, and the copy protection allows two installations. Configuring the program is more difficult, partly because *Impressionist* is designed to accommodate multiple users without mixing up their respective files or device drivers. You can set up as many work directories as you like, and each must have its own configuration files. So after you configure, you must copy the device driver files to the subdirectory in which you plan to work. In this manner, one user may be set up for monochrome display and a dot matrix printer while an-

other user is set up for color display and a plotter or camera, and so forth. This is a good idea.

TECHNICAL TROUBLES However, my real trouble with configuration was the display console. There is no reference material on the questions you must answer in the configuration process, except a list of available devices. The test equipment was a 256K-byte IBM EGA board and a NEC MultiSync monitor. The choices on the video display adapter list in the manual included PC Graphics, EGA, Hercules, Plantronics, and a few others. I selected EGA. *Impressionist* then displayed three choices: 640 by 350, 640 by 200, and 320 by 200. Naturally, I picked the highest resolution, which the EGA supports. The program warned that I must have the memory expanded on the EGA board (which the test system had), so I proceeded with my other hardware selections, copied the files to my subdirectory, and started the program.

I followed the tutorial in the manual, typing in exactly what was printed. It was confusing, but I stayed with it until my data was entered and I had picked and titled a bar chart. What I saw on-screen when I displayed the graph was something else—a broken pattern of colors and shapes behind which could vaguely be seen the accurate charting of my data. After exiting and reconfiguring in the various EGA modes with no more success, I called

Impressionist *is one of the most feature-filled programs reviewed in this issue, offering all of the major chart types, as well as 3-D charts. It also supports a wide range of graphics adapters and output devices. The pie chart below was output using a Matrix QCR image recorder. However,* Impressionist *must have one of the worst user interfaces of any high-end software ever released for the PC.*

Impressionist
The Varied Sources of Income

Manufacturing 62
Equipment Leasing 6
Services 12
Publishing 13
Real Estate

technical support. Several suggested solutions were attempted, but we could not get the program to run in EGA. In frustration, I reconfigured for PC Graphics, redisplayed my graph, and was astounded at the ugliness of the default color scheme. I went down several menu levels to change the chart colors, but when I displayed the chart again, the colors were not right, and not much better than the defaults. However, the same output plotted to the HP 7475A was gorgeous, and color selections were what I had expected.

I had a number of other problems completing the charts required for this review. For example, after entering the labels for the bars (the years 1980 through 1986 in this case), the program displayed on-screen and on the plotter the numbers 198 below each bar, with plenty of room for the missing digits. I reentered the labels, with the same effect. Then I noticed an automatic label feature for months or years. I picked years and was prompted for the starting and ending years. I typed 1980 and 1986. And once again all the bar labels read 198. I took a walk, contemplated never coming back, but tried the last resort—tech support. As it turned out, another menu offers a choice for Label Length; the default is three characters.

Technical support for this product was good, with the exception of the EGA problem. The people I spoke with were helpful and understanding. They seem very used to guiding people through the menu mazes.

Impressionist hung up at several points when I tried to implement improvements to my charts. Several times the program crashed to DOS, and in all cases I lost the additions and edits I had performed. When I tried to exit to DOS, I thought I would have to reboot: I went down every menu and tried every choice, almost panicked by not being able to find a way out of the program. Everything is menu driven, so the exit *must* be on a menu, I assumed. I looked up Quit in the index; the reference manual cited the combination Alt-S. I figured Alt-S stood for Save or Store. It stood for Stop, and I found myself at DOS, having lost another session of edits.

Mainframe programmers, seasoned hackers, and users with a high tolerance level for frustration would likely have the

patience necessary to stick with *Impressionist* long enough to learn it well. But the rest of you can forget it. So long as you're using personal computers, there is no reason to use impersonal software.
—Phil Wiswell

PCchart

Aztek's *PCchart* may well suit users who need superior-quality charts and slides but who don't want to spend a lot of time learning how to make them. It's easy to use, can specify colors from a tremendous palette, and can generate impressive results (albeit only from professional slide production centers). The flip side of all this is a high price tag and some vexing diffi-

culties. At least a few of those difficulties, however, may disappear with the next release—and that could make *PCchart* a program worth having.

One of *PCchart's* main problems crops up almost immediately: it is copy protected and is difficult to run on a hard disk. In fact, the program runs much better on a dual floppy disk drive setup. In order to operate *PCchart*, you run a batch install program that adds a few files to the program disks to make them bootable. After that, whenever you want to use the program you have to swap disks in drive A: a few times before you can get started. Although you can save data files on your hard disk, you can't run the system from it, and that's truly inconvenient. An Aztek
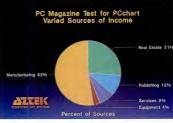
While PCchart can produce many charts in many variations, the basic formats for each look are predefined. The program can access a palette of up to 14,000 colors, which you output in the form of slides. You use an included utility to transfer image files to Aztek Art Centers and Slidegraphic Service Centers. The image below was output using the Aztek Film Station 4000 image recorder at an Aztek Art Center. However, the only way to get an immediate printout from the package is to use the PC's PrtScr key.

PC Magazine Test for PCchart
Varied Sources of Income

Real Estate 31%
Manufacturing 62%
Publishing 12%
Services 9%
Equipment 4%

Percent of Sources

AZTEK
COMPUTER ART SYSTEMS

spokesman said the next release would remedy this problem.

Once you get by the installation and start-up snafu, *PCchart* has a lot to offer. The program uses a spreadsheet-based paradigm to create charts, so both the screen appearance and cursor movement should make any spreadsheet user feel at home. You specify both a visual name (to select the graph type) and a data filename (if one exists), and then enter text and/or data into the spreadsheet cells. Pressing F2 generates the chart on the screen. Also, *PCchart* will import any data in .DIF, ASCII, or .WKS formats, automatically renaming the file with the *PCchart* "AZF" extension. Converted files can thus be graphed immediately without any other translation.

STRUCTURED APPROACH *PCchart* takes a fairly structured approach to producing charts, which has its good and bad sides. The product can produce many charts in many variations, but the basic formats for each look are predefined. This means that new users can simply enter data in the appropriate places and generate quality output without considering the

complexities of formatting and design. The drawback, of course, is that advanced users don't have the same control over their output's appearance as they would with some other products.

Still, if having everything spelled out for you sounds good, *PCchart* might be appealing, particularly given its superior output. The program accesses a palette of up to 14,000 colors. You can define and save palettes with chart formats and send the output to various slide centers for processing. The product includes a utility that allows transfer of image files to Aztek Art Centers and Slidegraphic Service Centers; also, you get a list of addresses where you can send data disks for generation of high-quality slides, film, and other output.

While *PCchart* can produce very high quality output at remote addresses, it can't do much locally. The product does not yet take full advantage of high-resolution screen drivers (although it functions with them) and has no direct output drivers. The only way to get an immediate printout is to use the PC's PrtSc key, which furnishes output of less than presentation quality. This problem, however, may be short-lived; Aztek says the program's next release will include some printer drivers.

Another, more minor problem relates to the way *PCchart* reads spreadsheet information. If you enter data and then delete it by backspacing or using the Spacebar, the program takes that to be a legitimate line of "null" data and reads it into the chart. Therefore, you may turn out charts that seem to be missing data. The remedy, obviously, is to exercise caution when editing the spreadsheet.

The documentation is adequate, although it could have added more detailed explanations in some areas, especially considering the program's structured way of looking at things. It does contain numerous examples of chart formats, however, and the utility disk has quite a few sample charts. Vendor support struck me as reasonable; the staff seemed knowledgeable, and I didn't have to wait long to talk with them.

On balance, *PCchart* presents a curious mix. It can produce some tremendous output professionally, yet it doesn't provide printer drivers. It is designed to make life easy for the novice, yet it won't operate

without an 8087 coprocessor installed. Although its drawbacks preclude a strong recommendation, many of them are apparently being addressed in the new release. In its current form, *PCchart* has a few too many stumbling blocks, especially for $695. If those are indeed removed, users seeking the ability to produce superior-quality output will want to look at this package. —**Jon Pepper**

PresenterPC

Dicomed Corp.'s *PresenterPC* is designed to produce disk files for final output through the company's high-end slide and film equipment, available for $150,000 or through Dicomed service bureaus. The package offers a selection of 24 chart types, including organization, tabular, and word charts. It incorporates sophisticated features such as moving text, printing in reverse, and a palette of 64 colors for complete, professional-quality presentations.

To use *PresenterPC*, you follow menus modeled after *1-2-3*: prompt words appear at the bottom of the screen, with an expanded prompt explaining the selected command. You press Esc to return to the main menu of seven commands and F1 to get context-sensitive on-screen help. To build a chart, you first load or create a chart

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file, defining basic characteristics such as chart type and size. Then you enter data on a spreadsheet screen—identifying ranges of cells as data or axis labels and defining colors for each range. You can also import data from spreadsheet or database programs that save files in .DIF format.

After you generate a chart, you can use *PresenterPC*'s freehand drawing capability to enter titles, labels, legends, and so on, from the keyboard. You can also play with the text, stretching it to any size or shape, slanting it at an angle or keeping it straight, and putting a box around it.

Besides its wide range of colors, *PresenterPC* incorporates three features that make it exceptional among business graphics packages. First, using *Presen-*

terPC's built-in graphics tools, you can add simple graphics (lines, squares, rectangles, and circles) to any chart. Second, you can select and move objects, including headings, legends, and graphic objects (but not the generated elements of the chart such as pie slices and bars), on the screen easily. Third, you can print text at any angle and even in reverse for a mirror-image effect. These features alone make *PresenterPC* a true artist's tool, rather than simply a business graphics generator.

TWO-FILE CHART In the end, each *PresenterPC* chart is composed of a chart format file and a .DIF file. The chart format file can serve as a style sheet for creating other charts. For example, you can cre-

PresenterPC is designed to produce disk files for final output through Dicomed's high-end image recorders or service bureaus, which is how the pie chart below was output. While the package can print images on dot matrix printers (used for the detail shown) and the HP LaserJet, the printouts are not suitable for final copy. The package itself incorporates sophisticated features such as moving text, printing in reverse, and a palette of 64 colors.

ate a whole series of pie charts using one chart format file that defines the chart's type, colors, borders, and so on, and a series of .DIF files.

Compared with the other graphics packages we tried, *PresenterPC* was relatively difficult to learn. The menu structure starts with seven main menu items and descends five levels to encompass over 300 commands. Even with access to context-sensitive help screens and the 500-page manual, we found it hard to interpret some of the menu words and messages. For example, text size is entered in numbers that represent width and height, but the on-screen help did not indicate what unit of measure we were to use. One screen message revealed that the text size was "1228, -2212"; it turned out this meant we could print text upside down and backward by entering negative numbers for height or width.

Luckily, most of the Dicomed service bureaus are value-added resellers (VARs) who sell the *PresenterPC* package to their clients and offer training. A few hours of assistance from an experienced operator could save days of personal exploration and calls for technical support. Our package included a list of 25 VARs in the United States plus 12 in the rest of the world.

The version of *PresenterPC* we reviewed could print images on dot matrix printers and the HP Laser jet for proofing, but the printouts were generally not suitable for final copy. For one thing, the package is designed to print in color, and no fill patterns are available for distinguishing between data groups printed in black and white. The next version of the product will add more output formats and device capabilities, including NAPLPS format (for Video Show), SCODL format (for use with the Matrix MVP rasterizer and Matrix QCR/PCR film recorders), TT200 thermal hard copy, and the Diablo Ink Jet Printer. Still, we expect that most users will want to use Dicomed's high-end equipment for their output.

Because of *PresenterPC*'s relatively long learning curve and complex menu structure, it is well suited for experienced technicians and serious users who need to produce high-quality slide presentations on a regular basis.
—**Diane Burns and S. Venit**

Wipes, Pans, And Fade-outs: Animating Your

BUSINESS GRAPHICS

Just as one picture is worth a multitude of words, a moving picture can communicate complex ideas and concepts better and more clearly than do static images. On-screen action draws attention, too, turning dull business pictures into the swirling images the television generation eats up.

Presentation graphics packages such as Brightbill-Roberts/The Marketing Channel and Co.'s *Show Partner*, IBM Corp.'s *PC Storyboard*, PCsoftware of San Diego's *Executive Picture Show*, and Visual Communications Network's *ExecuVision* and *Concorde* create such animation right on your PC's screen and even transmit

To catch the eye of a jaded audience, you'll need to add extra flourishes to your graphics presentations. The five packages reviewed here do just that by creating animated sequences right on your PC's screen or for use on a video display. But the downside to this advance in business presentation graphics is the software's limited color and resolution.

ANIMATING BUSINESS GRAPHICS

moving images to large audiences via videocassette recorders and video projection systems. Using such packages, you can make your business presentations not only clear and functional, but memorable.

Unlike traditional PC-based presentation graphics programs, which use the computer simply as a means of preparing graphic images, these presentation programs turn the PC itself into the presentation medium. The computer makes and displays entire shows and even allows viewers to interact with the show, branching it in different directions based on viewers' responses to on-screen prompts. Practical applications range anywhere from boardroom graphics to interactive training to advertising.

On the surface, all of these programs work like the functional equivalent of an ordinary 35mm slide projector. Central to all of them is the ability to organize a sequence of images that can be painted across a computer monitor or video display.

The software spices up the slide shows by electronically programming transitions. Television and motion-picture effects called wipes and dissolves are simulated by having one image push another off the screen, one screen pop over the previous one a pixel at a time, or a new image burst from an existing one. By changing an entire image or portion of the screen quickly and smoothly, the packages simulate rudimentary animation. Although they can't hold a candle to Walt Disney, their added action can breathe life into the dullest presentations or training exercises.

Of course, before you can have a slide show, you need slides. These video presentation programs address that issue as well. All have some ability to generate and edit on-screen images.

Most of the packages mimic free-form painting programs (like *PC Paintbrush* and *Dr. Halo*) so that you can sketch ideas on your video screen. However, these programs lack many of the features, depth, and ease of use generally associated with dedicated screen-painting products.

Most video presentation programs can also generate graphs from numbers that you either type in or import from file-based spreadsheet data. Although dedicated charting programs may provide more

graphing options, these new presentation systems give you a greater ability to enhance your charts using their graphics editors.

All of these video presentation programs incorporate some kind of screen-grabbing program that lets you record and store anything that appears on your monitor in a disk file. If you wish, you can later redisplay the screen as part of a slide show and, in many cases, edit and enhance saved screens.

Each video presentation program manufacturer uses its own format for the files that are grabbed from the screen. These files are not compatible with any made by the screen-grabber of a different manufacturer.

Most of these video presentation systems include a run-time module that allows you to package and distribute your finished slide shows on ordinary floppy disks. The run-time module automatically controls the on-screen display, based on the instructions generated by the slide-show package. Because the run-time module does not have the advanced editing features of the full video presentation package, it takes up less room on-disk allowing you to send out bigger shows, and it limits most unauthorized tampering with your video creations.

IMAGE IRRITATIONS A major problem with any sort of image-making—on paper, canvas, or computer—is the time involved. Although you can use and duplicate computerized designs very quickly, you are still stuck with the chore of creating an original image. Moreover, conjuring up pleasing images requires real artistry. These requirements are expensive in terms of time and talent, and, when it comes to developing complete animation sequences, the cost can become overwhelming.

The quickest and easiest solution to these problems is prefabricated artwork. The publishers of video presentation programs generally include modest libraries of predrawn images—electronic clip art—that you can incorporate into your electronic slide shows with a minimum of work. In addition, auxiliary libraries are offered by some publishers and, increasingly, third-party suppliers.

Although they can't hold a candle to Walt Disney, these programs add action that can breathe life into the dullest presentations or training exercises.

HARD LIMITS The ultimate on-screen quality of these video presentation programs is as good as anything you can display on your monitor. In general, they are quite quick in making on-screen changes. All of these programs face the same fundamental limits, however. Their quality can never exceed the modest capabilities of the various PC display systems. Their speed is highly dependent on the power of the computer the programs are run on.

Many of these programs are designed around the ordinary IBM Color Graphics Adapter (CGA) in medium-resolution mode, which allows four simultaneous on-screen colors with resolution of 320 by 200 dots. Such pictures make even Saturday morning cartoons look good.

If the slide shows are to be used and distributed as conventional video (see sidebar "Composite Video Output: From the PC to the Big Screen"), then the CGA is a mandatory choice. It is the only IBM video adapter with pretenses of compatibility with the NTSC (National Television Standards Committee) signals that are used by ordinary video monitors and VCRs.

Two of these programs—Concorde and Show Partner—push resolution and color selection up to the Enhanced Graphics Adapter standard: 640 by 350 pixels in 16 colors. EGA-quality slide shows can be shown directly only on EGA-equipped computer systems, however.

All graphics programs push the PC to its processing limit. Making and moving images requires a huge number of calculations, and updating screens fast enough that the audience doesn't fall asleep requires clever software design.

While all perform adequately on a plain PC, these programs benefit greatly from the added power of an AT or a faster compatible, both during the creation and the display of slide shows. Because images are stored on-disk until needed, action is speeded up and enhanced with a hard disk. In fact, many of these programs make a hard disk mandatory.

As with all software categories, the developers of video presentation programs each use their own unique user interface and mix of features, though the programs are designed for essentially the same end. Here's a guide to the currently available video presentation programs.

Because creating pleasing images requires real artistry, a requirement that is expensive in terms of time and talent, many of these packages include prefabricated artwork. The sample above comes from Visual Communications Network's Concorde.

Show Partner

While the original *Show Partner* rated mostly as a low-cost alternative to IBM's *PC Storyboard*, Version 2.0 gives the program a completely new personality. Whereas the original *Show Partner* was a bit buggy, the new version is the most polished of the video presentation packages examined in this article—and probably the most powerful.

Show Partner really shines in its consistent user interface, which is based on a Macintosh-like system of pull-down menus that you can control either by cursor keys or a Microsoft Mouse. (The program is included free with the Microsoft Mouse and many other products.)

Show Partner, Version 2.0, gives you two memory-resident programs to grab screens. Capture is a compact program that merely routes images to disk. The much-larger GraFIX Editor, *Show Partner's* free-form image creating and enhancing program, can also be made memory resident and will grab screens.

Either program works in any screen mode—text or graphics. Unlike some slide-show packages that require you to run a utility program from the DOS prompt to convert text screens to graphic format

for later editing, both *Show Partner* screen-grabbers handle this chore during the save process.

SHOW PARTNER ADDS SPICE TO PC LIFE

Editor Mike Sullivan uses Show Partner's visual presentation capabilities
to their fullest to publish the on-disk magazine PC Life.

Presentation graphics packages such as Brightbill-Roberts/The Marketing Channel and Co.'s Show Partner are a boon to business professionals who want lively demonstrations. But many business users may not be using the software to its full potential. Mike Sullivan, editor of *PC Life*, a fledgling magazine published on floppy disk, uses Show Partner in a variety of innovative ways that suggest possibilities for other users.

For instance, a review of *Microsoft Windows* in the magazine's first issue uses Show Partner for both its structure and its visual impact. "When we did the Windows story," Sullivan remembers, "we created an animated keyboard,

mouse, and screen to simulate how Windows actually works."

The resulting Show Partner graphic, generated in medium-resolution mode, faithfully mimics the functioning of Microsoft's new DOS environment. Simulated keystrokes and mouse movements produce appropriate changes in the animated screen.

The animation takes up about half of the monitor screen; the accompanying text scrolls by beneath it. While the scrolling text capability is not available to general users in the current version of Show Partner, it will be available in Show Partner Plus, which is due for release in the first quarter of 1987.

Another Show Partner feature that *PC Life* puts to creative use is the package's ability to pull in .EXE or program files without leaving the magazine. In *PC Life*'s second issue, for instance, readers can play a real computer game. When the game is finished, the magazine picks up where the reader left off. The magazine plans to continue using this feature.

PC Life also makes innovative use of Show Partner's familiar visual presentation capabilities. Sullivan uses unified visuals to keep the magazine's look consistent. For example, the magazine presents headings in a consistent fashion. For each story, a main headline scrolls up, a rule is wiped in beneath it, and a subhead is faded in beneath the rule. Similarly, the *PC Life* logo is presented consistently, though the accompanying artwork and text may vary. Other Show Partner techniques, such as wipes and fades, become part of the logo.

Story illustrations also serve to pique and sustain reader interest. A starburst, created with overlaid images, is one such device. A star appears, flashes, then fades. "What you want is to create a sense of anticipation," says Sullivan, "so the viewer doesn't know what to expect on the next screen." He says that many conventional cartooning effects can be easily adapted to Show Partner and can add visual spice.

While *PC Life* is a polished publication put together by skilled professionals, Sullivan suggests that many business users could tap many of the same capabilities he uses in assembling the magazine. "People tend to use the slide-show capabilities to show full-screen graphs," he observes, "when with a little more effort, they could fade in and out or even show a bar chart growing before your eyes. If they explored the program a little more, they would discover a lot more of its power."—**Jonathan K. Matzkin**

Switching between tasks running under Windows is easily accomplished with a mouse. To switch to MS-DOS Executive, for instance, the user moves its icon into the work area.

The screen is split down the middle, with windows of equal size devoted to Write and to

PC Life, a fledgling magazine published on floppy disk, uses Show Partner in a variety of innovative ways that suggest possibilities for other users. For instance, for a review of Microsoft Windows, PC Life created an animated keyboard, a mouse, and a screen that simulate how Windows actually works. The animation takes up about half the screen; the review text scrolls by beneath it.

This series of images showing the football player kicking the ball was created by PC Life using Show Partner. It demonstrates how you can use these types of packages to create animation. Despite the gee-whiz effect that such animation adds to your presentation, you'll notice that the quality of the images produced is only as good as your monitor can display. Many of the packages are designed around the abilities of the ordinary CGA, which allows four simultaneous on-screen colors with a resolution of 320 by 200 dots. Show Partner can also display in EGA, which permits 16 colors to be on-screen at once with a resolution of 640 by 350. Such pictures make even Saturday morning cartoons look good. For creating images most of these packages provide some sort of free-form paint capabilities; however, these programs tend to lack many of the features, depth, and ease of use generally associated with dedicated screen-painting programs.

Making the graphics editor memory resident may seem like a strange fluke, but it can be extremely useful. You can enhance charts as you draw them, even within an application, or you can change details while you are preparing a slide show.

The GraFIX Editor allows you to move, copy, flip, reflect, rotate, center, and erase on-screen areas. You can use it to enlarge (to double size) or shrink (to half size) screen images. GraFIX also includes primitives for drawing circles and boxes, as well as permitting freehand drawing in various line weights and colors. You can also use GraFIX to fill in shapes, change their textures and colors, and edit single

pixels using a handy zoom feature.

For text slides, you have your choice of 20 typefaces in three sizes and three slants (vertical, left, and right). You choose the options and color you want before entering text, and then you type the words you want just as you would with a word processor (without word wrap, however).

Show Partner lacks an internal graph-generating system. You have to rely on other programs to draw bar and pie charts, then import them into your slide shows using one of Show Partner's screen-grabbers.

You use the Show Partner script editor, Sed, to organize slide shows. The script editor uses the same menu-driven interface

and allows you to select the images, type and length of transition, and the screen area to be affected. It permits you to select several varieties of transitions from screen to screen, including simple replacement of one screen—or a portion thereof—with another; wipes along either screen axis or diagonally; a two-screen interweave; fading; and relatively smooth scrolling. You can assign one of three speeds to the effects, which vary with the model of computer used, and set display times for each screen from instantaneous to 999.9 seconds or tell the system to wait for a keystroke.

Since Sed includes enough programming-language-like commands to make

slide shows interactive, the show can branch in different directions depending on the user's response to questions.

Show Partner provides three internal sound effects (noise, bomb, and slide) and hooks for adding sound routines written in languages like Microsoft QuickBASIC, Turbo Pascal, and assembler. In addition, an expansion board, called the TrueSound Card (which is available from Webco, in Sacramento, Calif.) can digitally record sounds—voice, music, and effects—on floppy or hard disk and play them back with telephone-like quality, synchronized with the slide show.

Included with *Show Partner* is a run-time module about 15K bytes long called *Show*. Show, which can be distributed with presentations without royalty, precedes each presentation with a Brightbill-Roberts' copyright message. Alternative run-time modules without the copyright message are available for an extra charge.

A small clip-art library and animation demonstration is included with *Show Partner*. In addition, Marketing Graphics produces animated clip-art libraries for *Show Partner* (see sidebar "PicturePak Image Libraries Add Life to Presentations").

Show Partner operates with all standard IBM graphics adapters including the IBM Color Graphics Adapter, the IBM Enhanced Graphics Adapter, and the Hercules Graphics Adapter. Most display modes are supported, including the highest-resolution multicolor modes. Instead of using separate drivers, however, the program determines for itself what monitor and color display abilities are available and adjusts itself accordingly.

For hard-copy output (without animation, of course) *Show Partner* will drive any of about 60 printers and the Polaroid Palette film recorder.

The current marketing philosophy behind *Show Partner*, Version 2.0, seems akin to that of Turbo Pascal: offer a low-cost program at relatively little profit and make money with add-ons such as *PC PicturePaks* and the TrueSound Card. Other add-on products should be announced by the time this article appears. All this can be a big benefit—you don't need to pay for features you won't use. As with Turbo Pascal, the basic *Show Partner* Version 2.0, program is one of the best bargains

around, and it includes all the features that most people will ever need.

PC Storyboard

While other presentation graphics products came out before *PC Storyboard*, it was this product that gave IBM's stamp of approval to the category.

Four individual programs—Picture Maker, Picture Taker, Story Editor, and Story Teller—handle the separate functions of the *PC Storyboard* package. These programs come on three floppy disks and, when accompanied by the demonstration programs, take up slightly less than 1 megabyte of hard disk space.

Picture Maker combines a paint program, a graphics package, which creates graphics from data, and a free-form editor for manipulating existing images. You can also combine text with the graphics. *PC Storyboard* comes with a small clip-art library. Separately published image libraries, called *PC PicturePaks* (see sidebar, "PicturePak Image Libraries Add Life to Presentations"), are also available.

Picture Maker has a repertory of four basic chart types: vertical and horizontal bar charts, line graphics, and pie charts. However, the program does not readily import data from spreadsheets into graphs.

For text displays, Picture Maker offers five sizes of four type fonts including bold,

thin, roman, and PM (for Picture Maker). You can also choose the color of the text characters, as well as the outline and shadow colors, size, and position.

The Picture Maker graphics editor includes a few graphics primitives, commands that allow you to draw elementary boxes and circles, area filling, freehand sketching, and pixel-by-pixel manipulation, but it lacks many advanced graphics-manipulation functions such as the ability to rotate or reverse portions of an image. Size changes are limited to simple enlargement. Complex images are best drawn using another program and then imported into Picture Maker.

The frame-grabbing Picture Taker module redirects the normal PC printscreen function to route on-screen images to disk files. Although Picture Taker can capture nearly anything drawn in a standard IBM screen mode (40- or 80-column text and medium- or high-resolution graphics), it can edit only those images grabbed in medium-resolution graphics mode.

Once you've either created or grabbed images using the other two modules, you can use Story Editor to organize those images into presentations.

Story Editor works like a permanently formatted spreadsheet. All commands fit into individual data entry cells. First you specify the name of an image file, then the method, direction, and duration of the transition period between the images, and, finally, the length of its display. You can selectively change and edit parts of images. As you go along, Story Editor allows you to view each transition and alter it instantly.

Once you've organized your slide show with Story Editor, you show it using Story Teller, a simple run-time module. As such, Story Teller is the only part of the *PC Storyboard* package that you need to display the completed presentation. IBM grants a blanket license that allows you to freely duplicate and distribute the Story Teller module for use with your *PC Storyboard* presentations, provided you give a copyright acknowledgment in the presentation and on all disks that the module is copied to.

The command structure of *PC Storyboard* is a combination of menu- and com-

PICTUREPAK IMAGE LIBRARIES ADD LIFE TO PRESENTATIONS

Marketing Graphics makes graphics image libraries to enhance PC Storyboard and Show Partner presentations.

Let's face it. Good business people aren't necessarily good graphics artists. To help on business graphics users, therefore, libraries of graphics images, which often include maps, borders, and even drawings of people, have long been available with graphics packages to help dress up business presentations. But Marketing Graphics has put a new twist on these image libraries. The company offers them for other companies' products—namely, separate libraries for *PC Storyboard* and for *Show Partner*—and includes animation sequences more complex than the original packages can create themselves. Used judiciously, these animated sequences can add life—and even laughs—to otherwise ordinary presentations.

THE PC STORYBOARD SERIES

Each of the *PC Storyboard* series of *PC PicturePaks* consists of six floppy disks: four of static images to cut and paste into slide screens and two of brief animated sequences. Currently available titles include Eye-Openers, Holidays, the PC Family, and TypeStyles.

Eye-Openers are designed primarily as attention-getters general enough to fit almost any business situation. The images and action help boost success, motivate sales, and otherwise create a modest uproar. Holidays include seasonal scenes and calendar dates. The PC Family is designed for those folks who sell IBM per-

sonal computing equipment or train others to use it. It includes images of almost everything in the current product line, including such animated wonders as printers that continuously churn through paper and a finger poking a keyboard. TypeStyles extends the small variety included with the *PC Storyboard* package itself.

THE SHOW PARTNER SERIES

The *Show Partner* series of *PicturePaks* each include 60 full-screen illustrations, more than 100 icons and symbols, and ten animation sequences. Although the *Show Partner* series shares many images with the *PC Storyboard* set, it is targeted more toward business.

Its Executive and Management Edition includes highlights and introductions suitable for kicking off presentations, as well as many borders and backgrounds. The Finance and Administration Edition includes images that focus on such topics as time and money, productivity and performance, and communications and technology. The Sales and Marketing Edition images reflect goals and motivations, people and places, and travel and entertainment.

As is the case with the slide-show programs, the images included in the *PC PicturePaks* libraries can also be duplicated and included in presentations as long as the proper credit is given to the publisher.

mand-driven designs that requires you to specify several parameters to describe the chart. Help is available by a press of F1.

COMMANDS *PC Storyboard* requires you to use cursor keys for freehand drawing. No provision is made for mouse control, though some generic mouse drivers

will adequately convert mouse movements into cursor strokes.

By the now-normal convention, a press of F1 brings in-depth on-screen help, which is especially useful on two-monitor systems: the help appears and lingers on the monochrome screen even after you resume drawing.

Although quite useful for business presentations, *PC Storyboard* is limited by its medium-resolution, CGA-only (four-color) display quality. (Although the *PC Storyboard* system will work with the IBM Enhanced Graphics Adapter, it is not designed to take advantage of all the color and resolution capabilities of that hard-

You don't have to take this from your accountant anymore.

ware.) The program does feature a special composite video mode that allows an increase in *apparent* resolution and 16 simultaneous on-screen colors on composite color monitors.

Executive Picture Show

Executive Picture Show, introduced roughly 2 years ago by PCsoftware of San Diego, was one of the first packages of its type. While it is stuffed full of small programs and utilities and the whole functions together smoothly, it is upstaged by some of the newer packages which offer many more features.

The package's initial screen gives you a choice of several program modules: Draw, Graph, and Vector, which allow you to build and edit various screens and characters; Create, which lets you organize slide shows; and Show, which actually runs the slide shows in real time. A screen-grabber and a run-time slide-show module function as separate programs and run from the DOS prompt.

Using *Executive Picture Show* is tricky.

To control the program, you answer prompts and use single-letter commands and function keys. But unlike most modern software, the definitions of the keys change in the different program modules. Even a simple matter like backing up to a previous menu or leaving a program requires you to learn a number of different commands, such as Q, Z, and Esc. In some places, when the program requests input, you can highlight selections using function keys. In others, you must type in everything—such as filenames—even if the program has already listed the names for you.

When you use the Draw module to paint the screen, you control the graphics cursor using the cursor keys. Mouse support, for any of the three-button Mouse Systems products only, is built in, but *Microsoft Windows*–like pull-down menus are not.

The package includes all of the most frequently used free-form drawing commands such as dots, lines, circles, arcs, and boxes. You can move, copy, and erase sections of the screen individually, as well as fill objects with solid colors or a selection of patterns.

Several typefaces are available for text slides. You can edit or add individual characters or even whole fonts at any time. Typing options permit you to change the angle of text on the screen, the size of characters, and the slant of the italic characters. Larger characters appear in outline, and you can fill them with solid colors or patterns.

The Graph option, available through the main menu, allows you to quickly create business charts in your choice of seven styles, including line, bar, horizontal bar, stacked bar, 3-D bar, surface diagram, and pie charts. Unfortunately, since the program cannot import any data, you must enter the data for charts manually in response to a prompted template.

A nice feature of *Executive Picture Show* is that it allows you to create interactive slide shows—though you pay a price in speed. You can set up presentations to ask questions and branch to different displays depending on the response. Most choices—such as screen colors and type of transition—are prompted, which is nice because you don't have to remember a lot

of commands and you can see the results of your selection immediately.

You can start slide shows from the main menu, using the Show option. To view individual images, you can start it from the DOS prompt.

Executive Picture Show provides a wonderful aid for making the floppy disk copies of your show to distribute. You merely execute the Makerun program at the DOS prompt and tell the program which show you want to put on a floppy disk; the program then copies all the necessary programs and images to the floppy disk.

The screen-grabber utility, called ScrnGrab, compresses text or graphics screens when it saves them to disk. Text files, nominally 4K bytes long, can sometimes be compressed down to 500 bytes; typical 16K graphics screens can be squeezed into files between 3K and 12K long. Although *Executive Picture Show* treats text and graphics screens differently in editing, a special utility converts text displays into graphics files.

In addition to video displays, *Executive Picture Show* will also put images on paper using a variety of printers and the Polaroid Palette.

To create animated sequences, *Executive Picture Show* buffers images to RAM. An unusual feature is that the package requires you to assign memory to these buffers by running a utility before entering the main program.

PCsoftware supplies a small library of predrawn images as an option at $35 apiece. Four disks were available at the time of this writing, and they contained borders, full-screen pictures, maps, and icons.

The modular nature of *Executive Picture Show* keeps its memory requirements down—only 256K of RAM is required—and the program will run with few problems on dual floppy disk systems, though, of course, a hard disk will enhance performance. The program also seemed a bit more sensitive to microprocessor speed than most and benefits greatly from a high-speed computer. Although PCsoftware claims that the program will run on any graphics monitor (including monochrome), it is limited to CGA colors and resolution.

On the surface, all of the programs reviewed in this article work like the functional equivalent of a 35mm slide projector. Central to all of them is the ability to organize a sequence of images that can be painted across a computer monitor or video player. The software is then able to spice up these slide shows by electronically programming transitions. Television and motion-picture effects called wipes and dissolves are simulated in a number of ways. In the images shown here, created using Executive Picture Show, the computer pushes the dollar bill off the screen. Other methods include having one screen pop over the previous one a pixel at a time or a new image burst from an existing one. By changing an entire image or portion of the screen quickly and smoothly, the packages are able to simulate rudimentary animation.

ExecuVision

Not just a pioneer in presentation graphics, Visual Communications Network claims to have actually coined the term 2 years ago with its introduction of ExecuVision. The graphics program was designed to create bright, colorful, impact-generating on-screen images and limited animation using IBM's medium-resolution Color Graphics Adapter.

Compared with more recent products—and in particular its high-powered offspring, Concorde—ExecuVision is as primitive as its age would imply. Essentially, it is a painting program enhanced with a slide-show sequencer. It even lacks features that are expected as standard equipment today—for instance, a screen-grabber.

The program terms itself a "five-phase" system based on its initial menu selection: Create, Prepare, Print, Run, and Quit. The center of the program is the Create phase, which allows the free-form drawing of pictures, text charts, or graphs using both a menu-selection system and the cursor control keys. Prepare organizes slide shows and is able to handle limited animation. Run actually displays the shows in real time. Print makes hard copy of ExecuVision images, and Quit returns you to DOS.

The graphics feature of Create is primitive. For instance, it cannot import data directly from spreadsheets. Moreover, the nine type fonts used for text charts are all monospaced. Controlling the program is somewhat cumbersome since you must use long series of keystrokes and learn many key combinations. Yet, with patience, ExecuVision will produce sharp, attention-getting images.

ExecuVision's greatest strength is its optional library of predrawn images, which resides on 16 floppy disks. Unlike those of most libraries, the images in the VCN database are large and highly detailed—probably the best available today in medium-resolution CGA mode. Many of them take up the entire screen.

ExecuVision includes facilities (in Create) for cutting and pasting images, as well as changing their size, orientation, and

even their color. Included in the database
are a number of borders, maps (including
city road maps of many major American
cities), city skyline views, and thematic
subjects. The image database would be
reason alone to buy *ExecVision*—were
not the same library included as part of
Concorde.

Concorde

Visual Communications Network's *Concorde* pushes beyond *ExecVision* into the
realm of high resolution, simplifies operation, and adds as standard features many of
ExecVision's options. The new program
takes advantage of the 64 colors on IBM's
Enhanced Graphics Display and allows
you to blend charting, painting, text slide-
making, image capturing, and automatic
interactive slide-show capabilities. It includes its own image library and can also
make use of images developed under *ExecVision* or included in that program's library.

Concorde's four modules, called Create, Produce, Show, and Capture, are unified by a single master program and a common data structure and user interface. The
user interface, based primarily on a horizontal bar menu selector similar to the
command structure of *1-2-3*, allows you to
select individual functions either by mov-

COMPOSITE VIDEO OUTPUT: FROM THE PC TO THE BIG SCREEN

Once you've put the time and effort
into creating an animated presentation, you'll want the world to know about
it—or at least make a presentation to a
wider audience than the one that fits
around your PC's monitor.

Luckily, all of the presentation graphics systems reviewed here can generate a
composite video output when you use
them with a CGA-standard video adapter. This means that you can project the
changing video displays to large audiences using standard video projection
systems or Kodak's DataShow overhead
display system. You can even record and
distribute the video output of these packages with any videocassette recorder:
Beta, VHS, or compatible system.

The key to the video compatibility of
these programs is the IBM standard Color Graphics Adapter, which is the only
IBM display adapter that provides a composite video output. This signal, which
you access via the round RCA pin-plug
jack on the CGA retaining bracket,
roughly approximates the National Television Standards Committee (NTSC)
specification for video signals that is used
by nearly all North American and Japanese video systems. (Other parts of the
world have different video standards.)

The pictures made with the composite
signal will not be as sharp or colorful as
those appearing on EGA monitors when
an EGA card is used. EGA cards, however, do not generate signals compatible
with the NTSC composite video standard.

NTSC video signals will display on
any standard video monitor or projection

system and can be recorded by most video-
cassette recorders (VCRs). Using this
software, therefore, you can create a
slide show on your computer, record it
on your VCR, and distribute the entire
show on tape all across the country. The
tapes can be played back on any video recorder of the same format without a computer system.

Alternatively, you can plug the composite video output of your CGA card
into a video distribution system—for instance, a corporate video system. Using a
modulator, a composite video signal can
be converted into an ordinary television
signal—for instance, that of a broadcast-
ing channel used in your area—and connected to a television set or cable television system.

One problem you might encounter is
that because of the CGA's loose interpretation of the composite video standard,
some monitors, video recorders, and
similar equipment react badly to the output put of some CGA cards. (The output
from the IBM Color Graphics Adapters
I've tested varies widely from the commercial video standard.)

In some cases, a video processing amplifier can improve incompatible CGA
outputs by taking apart video signals and
reconstituting them in a very controlled
fashion. However, professional-grade
"proc amps" are expensive. Another alternative is better consumer-grade video
enhancers: these often have their own internal video processing amplifiers built
in, which can help clean up a CGA signal
and make it more widely compatible.—**Winn L. Rosch**

ing a highlighted block over the desired
feature using cursor keys or by typing the
first letter of the menu name describing
that feature. Rudimentary mouse control is
built in, but *Concorde* does not use pull-
down menus.

The Create module can automatically
generate charts using data that's directly

typed in or imported from *1-2-3* (Release
1A and 2), *Symphony*, *Multiplan*, and
DIF file formats. You can even edit the
imported numbers using a spreadsheetlike
interface.

Plotting a chart merely requires you to
specify a data file or enter numbers, describe the chart (bar, line, pie, and so on),

PC MAGAZINE Presentation Graphics Software: Summary of Features

Product/ Manufacturer	Show Partner Brightbill-Roberts	Executive Picture Show PCsoftware of San Diego	PC Storyboard IBM Corp	ExecuVision Visual Communications Network	Concorde Visual Communications Network
FEATURES					
List price	$79	$245	$275	$395	$695
Vector graphics capabilities	●	●	●	●	○*
Raster graphics capabilities	○	●	●	●	●
Generates graphics from data	○	●	●	●	●
Imports data from other programs	○	○†	●	●	●
Edits graphics produced from other programs	●	○	○	●	●
Has clip-art files	●	●	●	○	●
No. of fonts available	20§	13	4	11	17
Preprogrammed slide shows	●	●	●	●	●
User-definable slide shows/animation	●	●	●	●	●
Branches based on user responses to prompts	●	○	○	○	●
Customized sound	●	○	○	○	○
Screen-capture routine	●	●	●	●	●
HARDWARE SUPPORT/OPTIONS					
Hercules	●	●	○	●	●
EGA	●	○	○	●	●
Mouse	●	○	○	●	●

▣ —Indicates Editor's Choice ●—Yes ○—No

*Version 2.0 will have vector graphics capabilities.

†Version 4.0 will import data from other programs.

§Plus separate font editor.

and enter captions and titles. You can specify legend locations and numeric fields by typing in coordinates or interactively using the cursor keys to mark off the appropriate on-screen area.

The Create module also allows you to prepare text slides. The process is almost as easy as typing into a word processor. You need only position the cursor and type away; you can even relocate whole lines of text if you like.

A repertoire of 15 high-resolution or 15 medium-resolution proportionally-spaced typefaces ensures variety of your text. Text features also include your choice of character size and color, text orientation (rightside up, upside down, and parallel to the left edge of the screen or right edge), shadowing, underlining, and character tilt (for italics).

Concorde does offer paint capabilities, but they are very limited in scope: they include only a few graphics primitives for drawing basic shapes and allow such basic functions as moving and erasing blocks of text and sketching. Concorde's drawing abilities are constrained to brush (line drawing) and spray (random dot) techniques, both of which you can operate using the cursor keys. Colors, drawing modes, stroke weights, and spray densities can all be selected through menus. You can magnify images for fine editing, as well as rotate, reverse, move, and copy shapes and screen areas.

Concorde's screen-grabbing Capture function is compatible with 80-column text and graphics modes and can grab images made with video digitizing systems. After it has been loaded into memory at the

DOS prompt, you invoke the capture function by pressing the Shift-PrtSc key combination.

Concorde's Produce function gives you a blank form in which you fill in the name of the image you want displayed, the type of transitions, how long you want it displayed for, the amount of time for the transition, and the location of the image on your screen. As with Concorde's Create function, Produce lists your choices and lets you select from them using cursor keys. When you must specify a screen location, you can either enter coordinates or find the right location using cursor keys. You can preview each transition or the whole show as you go along.

Produce includes a programming-language-style capability that lets you add tunes (derived from the PC's single-voice

oscillator), color and fill images, type text on the screen, and interactively react to responses typed at the keyboard. The latter allows presentations to branch to different displays based on the viewer's response—a feature very useful for computerized training exercises.

Show is *Concorde*'s run-time module. It will automatically display the images drawn or captured by the other elements of the program independent of the original modules following the instruction you wrote using Produce.

Concorde can also function as an ordinary hard-copy-type presentation program and will generate overhead or 35mm slide images.

Concorde's biggest asset is its image database, which is derived from *ExecuVision*'s optional database but is included with *Concorde* as a standard feature. In addition to the *ExecuVision* medium-resolution images, *Concorde* includes one disk each of high-resolution graphics and animation libraries.

Each module (except memory-resident Capture) of *Concorde* is large—roughly 200K bytes—and the whole package requires nearly 2 megabytes of disk space. Capture eats up 56K of RAM. Running *Concorde* with medium screen resolution requires 384K of RAM; high resolution takes a full 640K. It's compatible with

IBM's CGA or EGA, Hercules Graphics, and AT&T color systems.

The program is big, and, although it's ponderous to use when producing, it's quick during presentations. On the one hand, its strongest points are its consistent interface and file structure, large image library, and many features. On the other hand, it is both expensive and copy protected. However, Version 2.0 of *Concorde*, due out by the time this article appears, will feature new documentation and new hardware drivers and is not copy protected.

CONCLUSION With one of these packages, you should be able to put enough sizzle into your presentations to not only keep your audience awake but to make your presentation memorable.

Winn L. Rosch is a contributing editor of PC Magazine.

SPECIALIZED GRAPHICS SOFTWARE
The Quick And Clean Solution

A general practitioner is not the best doctor to approach for plastic surgery. Similarly, a general-purpose charting program is not your best bet for your specialized graphics needs. General-purpose programs either cannot create organization charts, Gantt charts, flowcharts, and text-only charts without a great deal of difficulty or cannot create them at all.

While an organization chart is a common business graphic, it presents difficulties for many programs. Most graphics packages translate numeric data into a graphic representation; it's the shape of the graph that conveys the point. Organization charts, however, aren't numeric, they're positional. With them, it's not the shapes but

If you need specialized graphics such as organizational, Gantt, flow, or text charts, you could be shortchanged by a general-purpose graphics package. The six products reviewed here will give you the best possible output in one or more of these specialized areas.

their positions on the chart that convey the message—the hierarchy of superiors and subordinates that makes up the structure of a business. Specialized packages allow you to enter positional information into data entry screens or menus, saving you the trouble of drawing and aligning boxes, centering text, and so forth—if your package even has drawing capabilities to do that.

Another type of chart with unique graphic properties is the Gantt chart. Although it resembles a bar chart on the surface, it deals with time rather than values. Gantt charts, which measure the duration of individual activities in order to help you track them, are often created by project management software. However, they are relatively uncommon in general-purpose charting packages.

Text-only charts aren't particularly complex, but they can be dull if not prepared with creativity and care. Packages that specialize in this type of chart provide a wide variety of type fonts and sizes, as well as icons, to enliven your charts. Flowcharts represent program steps, systems operation, and the like. They use a system of conventional symbols developed over the years, with each shape conveying the nature of the operation illustrated. If you understand the symbology, flowcharts can be a highly effective method of documenting program logic. Flowcharts can also be used to track nonprogramming activities in business and other areas. Again, flowcharts are almost nonexistent in a general-purpose package.

If you need one of these specialized forms of charts, consider the packages reviewed here. Though limited, they may give you the best possible output in their specialized areas.

Diagram-Master

The Decision Resources (recently acquired by Ashton-Tate) family of business graphics tools—which includes *Chart-Master*, *Sign-Master* (both reviewed elsewhere in this issue), and *Map-Master*—has long been one of the best-selling groups of graphics programs. *Diagram-Master*, the newest member, will undoubtedly follow in the family tradition. It is a specialist that produces organization and

Gantt charts, and has a few extra tricks as well.

Diagram-Master consists of three major subsystems. The first is a Drawing Board, a chalkboard on which you can place text; draw a variety of geometric entities, such as boxes, polygons, circles, ovals, lines, and arcs; and import symbols from a library of 101 symbols, including grids, balloons, and flowchart symbols. You can also easily draw and save your own symbols.

Within the Drawing Board, you have good control over entity characteristics: You can choose one of eight colors, eight line types, 16 thicknesses, eight hatching patterns, eight arrow sizes, and eight arrow types. Strangely, you can't create a normal line arrow pattern. Seven high-quality text fonts and a font with a variety of useful symbols are also available. You can also zoom in and out, shrinking an image or enlarging it to fill the screen.

The second subsystem allows you to create organizational charts. To do so, you answer a series of prompts, and *Diagram-Master* automatically draws appropriate boxes and interconnecting lines. You can define multiline titles, have full control over font, type size, justification, and color, and choose from four variations of chart layout. A nice feature is that *Diagram-Master* lets you preview the finished

Glenn A. Hart Associates, Inc.

Proposed Staffing
December, 1986

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                    Glenn A. Hart
                      President
               Chief Executive Officer

  James Nudler      Alan Neuman      Ron Joensen      Richard Stork
  Vice-President    Vice-President   Vice-President   Vice-President
    Training          Service       Software Quality  Field Operations

  F. Douglas        A. Grange
  J. Edwards        M. Harrison      W. Button         A. Smith
  P. Frank          B. Isaacs        T. Cohen          L. Jones
                    G. Schwartz
```

Diagram-Master includes three subsystems. One allows you to create organizational charts, giving you full control over fonts, type sizes, justification, and color; you can also choose from four variations of chart layout. The second subsystem produces Gantt charts, allowing you to specify time periods, time divisions, number of activities, and more. The third is a drawing program into which you can import and enhance charts prepared with the other two subsystems.

chart on the screen, saving you quite a bit of plotting time.

The third subsystem produces Gantt charts and works similarly to the organizational charting subsystem, though the greater complexity of its time line graphics means there are more decisions to make and more prompts to answer. You can specify the time periods to use, how many time divisions to show, how many activities to include, how to differentiate the various bars, and more. The process you use to draw the actual bars is similar to that used in drawing programs. You mark the beginning of the bar, move the screen cursor to the end, and then mark it.

ENHANCING CHARTS The beauty of *Diagram-Master* is that you can load organization or Gantt charts that you have already prepared from other subsystems into the Drawing Board subsystem for further enhancement using all the tools it provides. You can draw lines, add text blocks, insert library symbols, and so on. This capability adds yet another dimension to the

already fine charts that are produced automatically.

The excellence of the basic structure of *Diagram-Master* is marred somewhat by incompleteness in some areas and several peculiarities. One incomplete aspect is that the installation procedure only accepts drives A: through D:. The configuration file, however, is an ASCII text file that you can easily change to make the program usable on any hard disk volume. If the installation routines won't handle drives past D:, the instructions for changing the configuration file should be documented.

Diagram-Master supports CGA, PGA, and Hercules video adapters but only partially supports the EGA standard. It uses CGA graphics in most operations. Although EGA is not mentioned during installation, if *Diagram-Master* determines that EGA is present, it will use its higher-resolution mode for full-screen previews. Given *Diagram-Master's* high price, full support of the popular EGA should be provided. Also, the program supports a light pen but not a mouse. A mouse would be a

natural for *Diagram-Master* because of its drawing capabilities, and the next release of the program will likely support it.

Peculiarities of *Diagram-Master* include the following: the Rotation commands set North, rather than East as most programs do, as 0 degrees. Most users will feel that 45 degrees should slope up to the right, not to the left as it does with this program. A diagram library stores a brief description of images, but you can only list them in the forward direction. If you miss a name or want to end your scan without looking at all the names, you cannot move back a page. Another perplexing problem that occurred was that I lost a saved image; it appeared in the disk directory, but *Diagram-Master* couldn't retrieve it. It turns out that you can't use DOS commands to manipulate files outside *Diagram-Master* because the program doesn't update its internal listing of the files with the changes made in DOS.

Screen painting is noticeably slow, especially on curved objects, and the operations set no speed records either, even on an AT running at 10 MHz. *Diagram-Master* is written in compiled BASIC, which may not be the theoretically "correct" language for a graphics program, but you can't argue with the quality of the results.

When I tried *Diagram-Master* on a system with a standard plotter, everything worked as advertised. I did, however, have trouble getting the program to work with my Laserjet Plus, but I have an unusual configuration. Decision Resources' technical-support staff gave me a rather nonobvious sequence of commands to work around the difficulty.

Finally, *Diagram-Master* uses the annoying SoftGuard method of copy protection that places hidden files on your hard disk if you want to run the program without a key disk. Decision Resources told me it plans to remove the copy protection in the future.

For all its shortcomings, the final proof is in the output quality. *Diagram-Master* delivers. The organization and Gantt charts were very attractive when output with a laser printer and a plotter. The output was as lovely as that produced by presentation and business graphics programs. The control you have over color, font, element size, and other characteristics makes

the charts much more interesting than those produced by some other programs, and the ability to dress up the output with symbols can make the difference between yet another dull chart and an arresting graphic presentation.

Diagram-Master is costly and has some rough edges that definitely should be cleaned up. Nevertheless, it is unquestionably functional and effective, combining ease of use with very fine results.

Diagraph

Diagraph, from Computer Support Corp., is a graphics package that allows you to create organization charts, forms, signs, word charts, flowcharts, and other presentation aids in an unusual manner. You create the images using a large assortment of typefaces, lines, and symbols included in a library of more than 2,200 standard symbols and several thousand optional ones.

Text features are very strong. Thirteen typefaces are standard, and you can purchase 24 more as options. You control text size, bold or italic emphasis, justification,

proportional spacing, and more. You can draw lines in any of nine line types, connect symbols, and add any of 47 "tokens" (arrowheads and similar symbols).

The standard assortment of symbols is *very* impressive, and includes accents, arrows, banners, boxes, geometric shapes in 2-D and 3-D, borders, stars, icons, signs, clouds, trees, and skylines, as well as organization, flowchart, office layout, network, and other symbols. Many of the optional symbols are stunning, too, especially libraries of anatomical, computer equipment, and mapping symbols.

You can manipulate any symbol in a number of ways, including scaling, rotating, and aligning. You can shade them using 250 patterns.

Although you can use all of these features and symbols to produce a wide variety of charts, some types of graphics are easier to produce with this package than others. For example, while it's easy to design organization charts, so many steps are necessary to make a pie chart out of individual symbols that you would be better

off using a standard business graphics package for common business charts.

Since *Diagraph* is unable to import images from any other packages, you can't use it to enhance external images (as you can with, say, *Freelance*), but it does such a good job of creating its own attractive images that many users may not care.

Installing *Diagraph* via the batch files provided presents no problems other than those presented by the SoftGuard copy-protection scheme. *Diagraph* supports a good number of matrix, laser, and ink jet printers, plotters, and film recorders. You can use CGA, EGA, Hercules, or several HP video adapters and appropriate monitors. The program runs much faster if you have an 8087 or 80287 math coprocessor.

Diagraph runs under a front end called Computer Support Applications Manager (CSAM), which you must use to boot up the program; it is used by all programs from this vendor. CSAM searches the disk drives you specify and even searches through all the subdirectories on those disks in order to find and boot up the pack-

For creating presentation graphics, Diagraph *comes standard with an impressive array of 2,200 symbols. You can manipulate the symbols by scaling, rotating, and aligning them. The package also includes a large assortment of typefaces and line types.*

age. Unfortunately, unless you specify the drive on which the package is located, CSAM spends an inordinate amount of time finding the program.

The package operates using a series of hierarchical menus. You give commands using only eight function keys (presumably for compatibility with HP computers), but the meaning of each key changes as you proceed through the menus. To make things easy for the user, the program always shows the current meaning of each key at the bottom of the screen.

The manual includes a fine interactive tutorial and clever minilessons and exercises for specific applications, but most of the documentation consists of pictures of the plethora of symbols. A competent online, context-sensitive help system fills in the gaps.
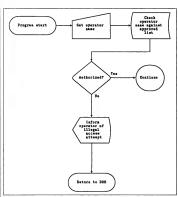
The extensive standard symbol library sets *Diagraph* apart from similar products. You can spend a lot of money if you add many of the optional typefaces and symbol libraries, but the quality of the results you can obtain is first-rate. *Diagraph* is flexible, potent, and fun to use.

EasyFlow

Flowcharts were developed to represent software operation and systems graphically and are one of the best methods of documenting how a program works. The symbols used in them, such as those for the hardware components (keyboards, disk drives, and CPUs) and the software operations (decisions and subroutines), have been standardized by convention. In addition, some businesses have adopted flowcharts to represent the flow of their activities.

Traditionally, flowcharts have been drawn by hand, by tracing the necessary shapes from a template and filling them in with text describing the operation. This method of preparing flowcharts is tedious, especially because they usually require many stages and modifications.

EasyFlow, from HavenTree Software, is a graphics program that greatly simplifies the process of flowcharting. It enables you to place any of 36 common shapes, many of which come in three sizes, anywhere in a fixed matrix that the package defines. This matrix assures that items of

EasyFlow greatly simplifies the process of flowcharting. You can use up to 36 common programming symbols in your charts. Once you place a shape you enter the text that will go inside it; the package automatically centers and positions the text. EasyFlow then automatically draws connecting lines between shapes, indicating program flow.

varying shapes are aligned properly. Once you place a shape, you can enter the text that will go inside it. Then *EasyFlow* automatically centers and positions the text for best appearance. Or you can override the default placement and place the text where you want it.
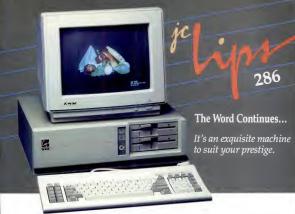
EasyFlow also automatically draws connecting lines between shapes, usually with arrows indicating program flow. Once again, you can override the program and control the placement of the connecting lines by indicating the starting and ending shapes and the direction you want the line between them to go. In addition, you can place up to four characters of text, such as yes or no for a decision, next to a connecting line, label each shape, specify a ti-

tle for the chart, and define blocks of text or lines that you can place anywhere on the chart.

LOTS OF WINDOWS *EasyFlow* divides the screen into several windows, giving you a screen layout that is well thought out and uncluttered. There's the main screen area, which displays your flowchart, a window displaying a magnified view of whatever is under the program's "shape cursor," another window displaying message text and instructions or options, and yet another one providing status information. Zoom-In and Zoom-Out commands magnify or reduce the portion of the chart displayed in the main window.

In addition to its windowing feature,

EasyFlow provides other nice touches and benefits for its users. Overall, the user interface is straightforward and easy to learn and use. Function keys, with a few Alt-key sequences thrown in for good measure, perform most of the program's commands. There is also the ease with which you can modify and edit existing charts. Cut-and-paste commands allow you to delete, move, copy, and even rotate or reflect individual and groups of shapes you select. And you can compress charts either horizontally or vertically by removing redundant white space, control page breaks, and other output details.

You can also use EasyFlow to define organization charts, with two special shapes provided for this purpose. The interactive nature of the program lets you see what your chart will look like sooner than a menu-oriented organization chart program, but EasyFlow isn't as powerful as some programs specifically designed for organization charts. For example, it draws boxes and connecting lines but doesn't automatically create the levels that are intrinsic to an organization's concept of superiors and subordinates.

There are some limitations with the program. There's only one text font, you have little or no control over font size, and the display doesn't use color to differentiate things, though you can specify the foreground and background colors on an EGA and can specify the pen to use for each shape if you're using a pen plotter.

EasyFlow automatically determines whether you have a CGA, EGA, or Hercules graphics adapter and adjusts its operation accordingly. It supports several IBM, Epson, and Okidata matrix printers, the HP 7475 plotter (which means many HPGL plotters will probably work, too), and the HP LaserJet and LaserJet Plus laser printers. Special graphics character fonts supplied with the package download to the LaserJet Plus for 300-dot-per-inch high-resolution output. Like most programs, EasyFlow lets you specify the output port (or a disk file) for its output. More unusually, you can also decide whether you want the output routed through DOS or directly through the BIOS for higher speed.

EasyFlow lives up to its name. It's hard to imagine any easier and more flexible way to produce basic and even complex flowcharts. Whereas you may have previously avoided flowcharts because they were a real pain to create and maintain, you can now add this great documentation tool to your arsenal of graphics presentation tools.

MonoGrafx

The basic premise behind Analytx International's MonoGrafx is that users with monochrome video systems, which lack graphics capabilities, should be able to create common business graphics. Although there are a few programs that let owners of monochrome systems specify the information necessary to plot or print charts, the process is usually like flying blind. You can't see what the charts will look like until they're printed, with the usual result being a chart that's not quite what you intended. You then have to modify your input and try again and again.

MonoGrafx works with the monochrome video adapter, whether you use a monochrome or color graphics system. It does so by using the special characters in the high-order portion of the IBM character set to draw lines, boxes, and shaded areas. And it shows you what your charts will look like while you're creating them.
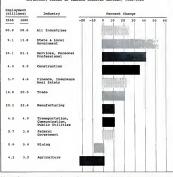
MonoGrafx also lets you expand or increase the size of text if your printer will support those capabilities.

As usual, though, you can't get something for nothing. The available characters include a few shading patterns, two line-drawing styles, a passel of miscellaneous characters, and not much else. Notably absent are curved lines, making circles and other curved objects out of the question. Surprisingly, however, the lack of curves proves much less restrictive than you would imagine. Other than pie charts, most business graphics use straight lines; business forms are almost totally rectilinear, too.

MonoGrafx's interface is first-rate. Obviously derived from Framework II, it has a menu bar at the top of the screen and full-down subsidiary menus. As with Framework II, MonoGrafx was inspired by the Macintosh. However, this program doesn't support (or particularly need) a mouse. If you want to specify individual characters, you can use function keys to pick 20 of the high-order characters. For some reason, though, you must specify many of the other characters with the clumsy Alt-key sequences. Normally, using MonoGrafx's Fill command, which conveniently displays all of the available characters in a pop-up window and lets you choose the one you want directly, is faster and easier than using keys.

MonoGrafx is generally fast (as one would expect from a nongraphics package, written in assembly language to boot). Drawing boxes, shaded areas, and lines is straightforward, although you may have to do a lot of column counting. Also, editing is especially easy, and MonoGrafx can produce reasonably attractive output and simple business forms. Ultimately, though, *MonoGrafx* is undone by the primitive drawing tools dictated by its monochrome character set.

A reasonably full-featured keyboard macro program named *Replay!* is included with the package. Unfortunately, *Replay!* is activated with Ctrl-key combinations that are used by many popular programs. Detailed instructions tell you how to change this, but why choose such keystrokes in the first place? Using a macro program with a chart package is a good idea, and the manual suggests several creative ways to use the combination to good advantage. *Replay!* isn't the equal of macro leaders such as *Prokey*, *SmartKey*, and *SuperKey*, but it's more than adequate for the tasks at hand.

The documentation for *MonoGrafx* is well written, comprehensive, and easy to understand. Both on-disk and printed tutorials help you get up to speed quickly.

MonoGrafx is available under two names: *MonoGrafx* and *FormWorx*. The two programs are essentially the same, the only differences being their names and packaging. The reason for the different packaging is that the programs are aimed at users with different needs. In time, each

program will be customized for its specific users' needs.

MonoGrafx works with the HP Laserjet via a special driver program called *JetWork*, which is supplied at no cost. The Laserjet, however, can't print the larger text characters, and you need the HP "Y" cartridge (the one with the full IBM character set) for *MonoGrafx* to work totally correctly.

Monografx's interface is first-rate. Derived from *Framework II*, it has a menu bar at the top of the screen and roll-down subsidiary menus.

MonoGrafx does absolutely the best it can with what it has, but I'm just not convinced that a nongraphics monochrome environment is the right choice for any chart and form preparation beyond the most casual or occasional needs. Given that a Hercules graphics card lists for less than $300 and is readily available at a healthy discount, and clone adapters are available for under $100, there seems to be little reason not to move up to monochrome graphics. This is especially true since doing so gives you a huge fleet of existing graphics software, including sophisticated business and presentation graphics, at low cost and without the need to scrap an existing mono monitor. There are obviously some good minds behind *MonoGrafx*. I'd like to see what they could do with real graphics.

OrgPlus

Organization charts can be difficult to create in any general-purpose business graphics packages—you have to draw the boxes, line them up, enter text, and so forth. But they are the raison d'être for Banner Blue Software's *OrgPlus*, and the

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package lets you make them easily, quick-
ly, and very well. Furthermore, it takes no
time to learn, yet it's comprehensive and
flexible.

OrgPlus's data entry screens force you
to assign levels to each employee accord-
ing to where he or she stands in the organi-
zation. You assign arbitrary numbers to
the job functions in the corporate hierar-
chy, 1 being the highest—so the president
would be at the first level and the vice pres-
ident would be at the second level. You
navigate through the levels, easily entering
names, titles, and comments for each one.
You can specify direct or dotted-line re-

porting, staff-level positions, multiline ti-
tles, and blocks of text annotations. It's
equally easy to add, delete, and move indi-
vidual titles and entire branch groups. And
you can even save and append parts of a
chart to another chart to make large, com-
plex charts manageable. There are some
organizational relationships that OrgPlus
cannot handle; one is that staff-level posi-
tions cannot have anyone report to them.
But in general, with 256K bytes or more of
RAM, OrgPlus can accommodate up to
350 distinct positions, more than enough
for most companies. Once you enter the
data, the program automatically draws the
lines and boxes around each name.

To enable you to enhance the visual ap-
peal of your charts, OrgPlus has eight dif-
ferent box styles and seven chart styles.
The program displays what the chart styles
look like, but only in general terms. There
is no on-screen preview of what your spe-
cific chart will look like when it's printed
or plotted.

Installing OrgPlus is simple: all you do
is choose your printer and page orienta-
tion. Solid lines and shading are available
with a reasonable selection of printers, and
OrgPlus can work with any other printer
by using ASCII characters instead of
graphics characters. It also works with the
HP LaserJet and HP plotters. When your
chart is printed, the program sometimes
selects fonts and changes the box styles to
make everything fit. I would like to see
more control over fonts on printers and
plotters and support of proportional fonts

on the LaserJets, but for the most part the
output looks very good.

If you need to produce organization
charts, for only $69.95, OrgPlus, a non-
copy-protected program, is a bargain. It
proceeds along its appointed rounds
smoothly, quickly, and effortlessly.

Sign-Master

Sign-Master is another member of the De-
cision Resources (now Ashton-Tate) fam-
ily of graphics programs. (See reviews of
Diagram-Master and Chart-Master else-
where in this issue.) Sign-Master's speci-
ality is text-oriented charts for presenta-
tions, projections, and slides. Although
many business and presentation charting
programs can produce text-only charts, the
results are often dull. With Sign-Master,
you can produce nice-looking charts by
choosing from seven attractive fonts (in-
cluding a useful symbol font supplied with
several Ashton-Tate programs) in any of
16 sizes and eight colors. In addition, you
can center or justify text, convert it to ital-
ics, and, using a table mode, you can eas-
ily draw boxes around text to differentiate
portions of your chart. Text charts may
never knock an audience out, but Sign-
Master's inspired techniques let them go a
long way toward capturing attention.

To use Sign-Master, you define your

OrgPlus's only purpose in life is to make organizational charts—and the package does it well.
OrgPlus allows you to specify direct reporting, staff-level positions, multiline titles, and more. To
enhance the charts, OrgPlus includes eight box styles and seven chart styles.

SPECIALIZED GRAPHICS SOFTWARE

BUSINESS ARTS UNIVERSITY

THE COLLEGE OF BUSINESS GRAPHICS OF
BUSINESS ARTS UNIVERSITY
PROUDLY CONFERS THE TITLE OF
DOCTOR OF SIGNS

UPON _____

It shall be declared that from this date forth that the above cited shall be referred to as a DOCTOR OF SIGNS and heretofore accorded the respect and praise of all.

DATE _____

Sign-Master specializes in text-oriented charts for presentations, projections, and slides. To spice up such charts, Sign-Master includes seven fonts in eight sizes. You can also center or justify text and convert it to italics.

Text charts may never knock an audience out, but *Sign-Master's* inspired techniques let them go a long way toward capturing attention.

chart by choosing options from menus and answering a series of prompts. You can enter, edit, and otherwise manipulate your text easily. *Sign-Master*, like other Ashton-Tate programs, also lets you preview your chart on the screen, showing you exactly how the hard copy, including the actual typefaces and colors, will look. Since plotters and printers can take a while to produce paper output, the preview feature can be a real timesaver.

Sign-Master worked without a hitch, and the charts we produced were snappy and attractive. The program worked fine with an AT computer, EGA video, HP Laserjet Plus, and various plotters. *Sign-Master* supports a long list of plotters and printers, so you shouldn't have any problem using it with any likely configuration.

The program's copy protection is aggravating, but no more so than any other program's. Our only other serious objection is the price. It's definitely on the costly side for a program that produces only one type of chart, especially when so many other business graphics packages throw in text chart capabilities. It does an excellent job, though, and if you create a lot of text charts *Sign-Master* is definitely worth your consideration.

Glenn Hart is a contributing editor of PC Magazine.

PRODUCING QUALITY OUTPUT:

When Only The Best Will Do

Y ou can find
lots of affordable software for
creating attractive business graphics.
But the best chart in the world is
of little value if it's being held hostage
inside your PC.

Although your options include print-
outs and plots of your charts, the
highest quality and most professional
output is achieved using 35mm
color slides. With 35mm, you can
produce high-resolution, crisp,
colorful images. According to a
recent study done by the 3M Corp.
in conjunction with the University
of Minnesota, slide shows are
perceived as being the most
professional form of presentation.
And those who use slides
are perceived as being more
interesting presenters.

Once you've used your graphics software to
create a thoroughly impressive image, you'll want
to produce professional-quality output.
That means 35mm slides. You can produce slides
either by using film recorders or by taking
your data to a service bureau.

Slide shows are
the most
professional
form of
presentation.
And those who
use slides are
perceived as
being more
interesting

QUALITY OUTPUT

You have two alternatives for translating your images into slides. You can buy a film recorder or screen camera or find a service bureau to create the slides for you.

The advantages of purchasing your own film recorder or screen camera are that you can keep sensitive material in-house. You'll also receive the fastest possible turnaround time. And, since producing each slide from a service bureau can cost from $10 to $50, in the long run, if you produce a high volume of slides, you'll save money.
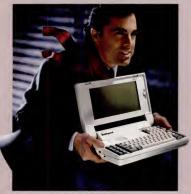
But film recorders do require a significant investment (the low-cost Polaroid Palette sells for $2,000, while high-end film recorders can go up to $225,000). The results depend on the resolution of your machine, which will vary from 640 by 700 for the Polaroid Palette Plus to 8,000 lines for Presentation Technologies' Image-Maker. Results will also depend on your selection of the correct film and the good working order of your film recorder. There's a steep learning curve, unless you invest in an accompanying staff. And, the in-house film recorder leaves you with a roll of film that still requires developing and slides that still need mounting.

If your business requires only a moderate amount of high-quality slides and you have a limited need for custom artwork, you might consider a service bureau. Service bureaus take PC-based data and images sent via modem or on a floppy disk and output the image to a high-resolution film recorder or printing devices. You can expect 4,000-line resolution as the standard from a service bureau. Some service bureaus also provide services that customize and enhance slides based on your specifications. The presentation-quality graphic is on its way back to you within 24–48 hours.

Turn to "Producing Quality Output: Three New Film Recorders" to find all the information you need to understand the technology and features of film recorders and reviews three of the hottest new products, Presentation Technologies' Image-Maker, the Polaroid Palette Plus, and General Parametrics' PhotoMetric 200PC. "Producing Quality Output: The Service Bureau Option" provides you with a roundup of the types of services available.—Robin Raskin

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Standard Features	
Clock Speed	9.54/4.77 MHz
Memory	640K bytes
Built-in Software	5 programs
Disk Drives	Dual 720K (3.5")
Screen type	Super-twist LCD
Keybd. Compatibility	IBM PC/XT*
Numeric Keypad	Separate
Weight	11.2 lbs.

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PRODUCING QUALITY OUTPUT:
Three New Film Recorders

*For keeping
sensitive
material in-
house, for the
fastest possible
turnaround
time, and for
long-term
savings, you'll
want your own
film recorder.
But you'll need
a significant
initial
investment.
Here we review
three of the
latest products.*

If you need to produce slides from the graphics you've created using software, you might consider a film recorder. Using your own film recorder will keep your graphics away from prying eyes, give you the fastest turnaround time, and create large numbers of presentations economically. However, you'll spend a minimum of $2,000 and could well require the services of a trained technician.

Once you decide to go with a film recorder, you'll need to understand how these products work and the similarities and differences between them in order to make the most intelligent decision for your application.

Film recorders and screen cameras are specialized combinations of electronic and photographic technologies that convert the images you've created with your computer graphics program into slides (and other photographic media) that you can use for presentations and publications.

Because they are not limited to the PC's display standards, film recorders can create images with higher resolution and a greater variety of colors than a PC can ordinarily display for a screen camera to capture. Film recorder images are usually sharper, more detailed, and more colorful.

A number of new film recorders have been introduced recently. These new recorders provide higher-quality images at more affordable prices than ever. We examine three of the most interesting new film recorders: the Polaroid Palette Plus, an improvement on the old standard; General Parametrics Corp.'s PhotoMetric 200PC, which offers a new means of capturing images that follow a familiar stan-

dard; and Presentation Technologies' ImageMaker, a radical film recording system that does away with the old bugaboo called the picture tube. For a look at other products in the marketplace, see "Putting It All on Film: Screen Cameras and Film Recorders," *PC Magazine*, Volume 5 Number 9. For the highlights of these products, see sidebar "More Alternatives" and the features table.

TECHNICAL TRIO Though different in many ways, all three of these new film recorders share similar technologies. Each is an imaging device that outputs to photographic film. Like a plotter or graphics printer (but unlike a monitor or screen camera—see sidebar "Film Recorders and Screen Cameras"), these film recorders are controlled by your computer. They do not use the image that your monitor displays. Rather, your computer sends control signals that tell the film recorder to draw shapes and characters, change colors, and even merge images.

Generally, all film recorders have three essential parts: the interface, the imaging device, and the recording device.

The interface is the combination of hardware and software that sends the control signals to the film recorder. Most film recorders are built around the RS-232 hardware standard and plug into a conventional serial port. In some cases, film recorders also use the PC's video output to help generate their images. The software portion of the interface either allows you to directly control the instructions sent to the film recorder, or it acts as a driver that allows another program to control the recorder. In the latter case, you see only the program that's in control, normally a graphics package.

Because no standards have yet emerged for film recorders, each one creates its own control codes. Each film recorder, therefore, requires a special software driver—which your graphics program may or may not have. As a result, software compatibility is a major concern when considering a film recorder.

SHARPER IMAGE Most film recorders (with the exception of Presentation Technologies' ImageMaker) use a conventional cathode ray tube (CRT)—in television par-

lance, a picture tube—as their imaging device. The size and quality of the CRT display plays a large part in determining the final quality of the images produced by the film recorder.

Your primary concern in the imaging system is its resolution: the higher the resolution, the sharper the image. Resolution is usually measured in the number of lines that make up the entire screen in a raster display on the CRT and, thence, on the film. Normal television pictures have a vertical resolution of about 480 lines. The vertical resolution of most PC displays ranges from 200 lines for the CGA display to 350 lines for the Monochrome Display Adapter and EGA.

The resolution of film recorders ranges from the pathetic PC standard up to a glorious 10,000 lines. Note, however, that 35mm film also imposes limitations on the resolution of photographic images in the range of 2,000 lines. (The greater resolution available from more-expensive film recorders is useful for larger film formats.)

Resolution figures are sometimes also given in terms of "addressability." Addressability relates to how precisely the recorder can position the electron beam in the CRT as it makes the image. It does not directly correspond to resolution because the beam has a definite size and a smaller beam can draw sharper images.

This beam width is rarely described numerically. While a smaller beam width can resolve a finer image, a wider beam is instrumental in helping to remove some of the jaggedness from raster images. For optimum operation and the best appearance of the final image, the beam width should be matched with the addressability of the system.

Nearly every film recorder (including the novel ImageMaker) uses a monochromatic image source, that is, white light. To put color on film, most use a color wheel through which the film is exposed to separate (and usually different) images in each of the primary colors of light (red, green, and blue). The film sums up the total exposure of all three colors to create a complete rainbow of hues.

In theory, film recorders using this system are capable of generating an infinite variety of colors. Reality and programming considerations often limit the num-

FILM RECORDERS AND SCREEN CAMERAS

Although often used interchangeably, the terms "screen camera" and "film recorder" describe two very different devices. The source of confusion is their common ground—both machines capture computer-generated images on film. Otherwise, the two differ in both function and philosophy.

The screen camera is designed to render the image that is displayed on the monitor of your PC as closely as possible on film. The film recorder is a computer-controlled output device that generates images that are independent of what you see on the screen. While the screen camera duplicates or captures an exact replica of the video display screen, the film recorder is more concerned with quality.

The screen camera either snaps the image directly off the screen of a PC or substitutes its own, higher-quality monitor. As a result, the film image has all the limitations of the standard PC color display—a very limited color palette and low resolution (at least by photographic standards). Although these images will improve as more screen cameras adapt to the newer, higher-resolution IBM Enhanced Graphics Adapter, they still remain limited by the design trade-offs

ber of available hues to a more modest number, six and up.

RASTER MASTER Most film recorders that use CRTs use either raster or vector displays, but the majority use the raster method. A raster image is divided into scan lines, each line consisting of a series of individual dots cut from a thin section of the final image. The electron beam in the CRT usually traces the lines back and forth down the face of the tube in a zigzag pattern. The intensity of the beam at any given instant determines the brightness of a single dot on the tube face.

The pattern of dots making up the picture to be displayed is usually memory-mapped—held in a block of memory ar-

IBM has made (and continues to make) in selecting its monitor standards.

The film recorder does not suffer from the limitations of the display system. It traces to film entirely new images that are produced by software running on the PC. For the most part, only this software must conform to the PC standard.

With most film recorders, the PC manipulates only the data that will be used in constructing the final image. This data is then sent to the recorder just like any other data, as a series of instructions that tell the recorder how to draw the final image on the film.

The PC must know the right commands to send to the film recorder, and it learns these commands from software, such as your graphics package. Therefore, to be compatible with a particular film recorder, a software package must have a driver for that film recorder. The software selection for a new or unpopular film recorder can be quite limited.

As a result, your choice of film recorder depends on the software you want to use. A screen camera is almost universally compatible. It will put any image on film that can be displayed on a monitor.—**Winn L. Rosch**

ranged in two axes that correspond to the height and width of the picture, and the information for each dot is read sequentially from memory. The bit pattern in memory exactly corresponds to the dot pattern on the screen. Ultimate on-screen resolution is limited, therefore, not only by the quality of the display system but also by the amount of memory devoted to storing the display information.

When the amount of memory is small compared to the capabilities of the display system, it is likely that unsightly jaggedness will result. Although the CRT is capable of displaying smooth lines, the dots will be held in the larger chunks that the memory can handle. The electron beam is forced to display the same jagged, chunky

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MORE ALTERNATIVES

In addition to the three devices examined in the accompanying story, *PC Magazine* last year reviewed five other screen cameras and film recorders ranging in price from $875 to $11,795.

One of them was the original Polaroid Palette, physically identical to the Palette Plus but only CGA compatible and packaged with accessories not quite as fancy. It's still available and priced at $1,995.

Here's a quick look at the other alternatives:

DATACAM 35

Photographic Sciences Corp.'s Datacam 35 is a genuine minimalist device—essentially a 35mm camera and special lens attached to a plastic hood that mates with an IBM monitor so you can snap screenshots. Although its on-film quality is low—an exact match for the IBM display standard—its usefulness is high. It's a point-and-shoot system with which you can take a picture of any screen in seconds.

COLOR DIGITAL IMAGER IV

Bell & Howell's Color Digital Imager IV (CDI-IV) is based on a repackaged (more massive in look but identical in function) Polaroid Palette, and becomes an integrated hardware and software graphics system when combined with Bell & Howell's *Graphics Express* software (which is based on Xenographics' *Mirage*). Refinements over the Palette include support for a super-high-resolution preview monitor and the ability to understand HPGL and, thus, use plotter software.

LASERGRAPHICS MPS-2000

Lasergraphics' MPS-2000 Management presentation system adds a sophisticated image processor—a separate, PC-size computer—to its Polaroid Palette foundation. The image processor interprets vector commands into the Palette's raster format and understands both its own command language and HPGL (which makes the system compatible with most plotter software). Its image addressability of 2,048 by 1,366 helps eliminate jagged images, but its sharpness is limited to that of the Palette itself (about 1,100 lines).

MATRIX MVP-PC AND MATRIX PCR

The Matrix MVP-PC/Matrix PCR system is the ne plus ultra of today's PC-based film recording systems. Its large, flat-faced, 7-inch CRT gives resolution beyond the capabilities of 35mm (4,000 lines) and really requires 4- by 5-inch film to be appreciated. The camera section is a free-standing unit that requires the expansion card-mounted MVP-PC coprocessor for control. As with the best of anything, it's expensive.

—Winn L. Rosch

image-on-screen as is held in memory.

Vector displays work much like draftsmen do. The on-screen image is drawn with strokes of the electron beam. The beam starts at one position on the screen and proceeds directly to another, tracing a straight line, with no jaggedness, between its starting and ending points.

The vector image is stored in memory as a series of drawing commands; the final image is not constructed until it actually appears on the face of the tube.

Vector images can often appear noticeably smoother than raster images. Many software packages create their patterns using vectors and then convert their results to raster patterns for display on the computer monitor. (Although vector images can be converted into raster images without too much difficulty, going the other way is an extremely complicated process.)

Despite their technical differences, another common thread unites the current crop of film recorders. The level of professionalism and finish among them tends to be higher than almost anywhere else in personal computing. All three of these units rate as well-integrated systems with thorough, professionally written and printed documentation.

Here's a closer look at each member of this elite trio.

ImageMaker

One of the chief limitations on the final quality of an image made by a film recorder is the resolution of its CRT system, since that image is usually nothing more than a picture of the CRT face. Unfortunately, CRT display systems with thousands of lines of resolution are expensive, delicate, and cantankerous.

Presentation Technologies believes that the CRT is the major impediment between you and higher-quality slides. Consequently, the ImageMaker uses no CRT. Instead it substitutes a mechanically complex optical system and a font wheel.

Like a phototypesetter, the Image-Maker focuses a light beam through transparent, picture-perfect characters on a black disk. The disk rotates the desired character into the path of the light beam, a special optical system then focuses the illuminated character on the film, exposing it and making the image.

The character images are arrayed in several tracks around a disk that is 6 inches in diameter and is held in a plastic carrier.

Instead of a CRT, Presentation Technologies substitutes a mechanically complex optical system and a font wheel into the ImageMaker, which functions in much like a phototypesetter.

The whole assembly is called a font cartridge, and it roughly corresponds to the daisy wheel of a fully formed character printer. Several sizes or styles of character are arranged in parallel tracks. You can easily interchange font cartridges—you simply pull one out and slide another in.

To make graphic images, the Image-Maker uses drawing styli, which are actually dots on the black character disk. The optical mechanism continually moves while imaging the stylus, creating vector-like strokes on the film, much as a plotter would. Presentation Technologies will also put often-used graphics symbols—for instance, company logos—on custom-made font cartridges.

In the ImageMaker, the light source is a 12-volt quartz-halogen projector bulb in a condensing optical system. To achieve different colors, filters with varying lengths of exposure are slipped into the light path. The current color selection allows 6 background and 16 foreground colors.

The image is focused on film by a lens assembly held by a mechanically complex arm that moves in two planes and is controlled by the ImageMaker. The placement of the lens determines exactly where on the film each character will appear. According to Presentation Technologies, the mechanism is accurate to .0005 inch (one-half of a thousandth of an inch).

Making a text-only slide typically requires 2 to 4 minutes. A complex graphics slide may take as long as 10 minutes.

At the front of the ImageMaker is a chamber containing a 35-mm camera that is concealed by a plastic door. The camera is constructed around the chassis of a Pentax do-everything reflex camera that lacks

Film Recorders: Summary of Features

Product/ Manufacturer	List price	Imaging method	Resolution (pixels)	Colors	Film backs available	Makes screen-shots	Accessories included	Control software copy protected
ImageMaker Presentation Technologies	$4,995	Font cartridge	8,000 (equivalent)	16 foreground 6 background	35mm	○	None	●
PhotoMetric 200PC General Parametrics Corp.	$5,995	CRT	2,000 × 2,000	1,000	35mm; 3¼- × 4¼-inch*	○	None	●
▶ Polaroid Palette Plus Polaroid Corp.	$2,999	CRT	640 × 700	72	35mm; 3¼- × 4¼-inch[3]; 3- × 4-inch Autofilm[2]	○	Power accessory,[2] illuminated slide mounter	●
Color Digital Imager IV[3] Bell & Howell Co.	$5,500	Font cartridge, CRT	2,000 × 2,000 (equivalent)	4,096	35mm	○	Auto processor[1]	○
Datacam 35[5] Photographic Sciences Corp.	$875	Photographic	CRT limited	Unlimited	35mm; Polaroid Instant Print	○	None	N/A
Lasergraphics MPS-2000[3] Lasergraphics, Inc.	$6,995	CRT	2,448 × 1,365	1 million	35mm	○	Auto processor[1]	○
Matrix MVP-PC Matrix PCR[3] Matrix Instruments Inc.	$13,795 ($2,495 MVP-PC only)	CRT	2,000 × 2,000 or 4,000 × 4,000	256	35mm	○	None	○

▶—Indicates Editor's Choice. ●—Yes ○—No N/A—Not applicable; impact not tested.

*Optional. [2]For developing Polachrome or Polapan instant slide film. [3]Reviewed in PC Magazine, Volume 5 Number 9. [5]Screen camera only.

PRODUCING QUALITY OUTPUT

The camera has a built-in motor drive but requires manual rewinding. Once the film is loaded, the camera needs no attention until you've shot the roll of film.

The whole ImageMaker assembly fits into a beige plastic case about the size of a breadbox. It connects to its host PC through a standard serial port.

The system can be controlled by Presentation Technologies' own *ImageMate* software, which generates both text slides and simple charts. Other software compatible with the ImageMaker includes *PC-Slide* by Management Graphics and, reviewed elsewhere in this issue, *Harvard Presentation Graphics* by Software Publishing and *SlideWrite Plus* by Advanced Graphics Software.

EXCELLENT TEXT SLIDES The ImageMaker-*ImageMate* combination is to other film recorders as a fully formed character printer is to a dot matrix machine. It

is superlative at making text slides. The recorder's graphics mode also provides abilities resembling those of a plotter. It therefore also does a reasonably good job of drawing colorful bar and pie charts in its graphics mode. But it lacks the versatility of a wide variety of instantly changeable type fonts and a diverse color spectrum.

The resolution of the ImageMaker is rated at the equivalent of 8,000 lines (equivalent because the ImageMaker has no lines). In fact, the ImageMaker is probably sharper than the film that it uses. On text slides, its quality on 35mm film looks as good as that achieved by CRT-based film recorders costing $10,000 and up.

If you primarily use text slides, you might be able to get by with just the ImageMaker. However, you'll more likely find it to be an excellent adjunct to a more conventional film recorder. Use the ImageMaker, therefore, when you want your text slides to make the best possible im-

pression, and use the other film recorder for elaborate charts and other graphic images.

● ●
Polaroid Palette Plus

The most popular of all film recorders undoubtedly is the Polaroid Palette. But as good as it is—good enough, indeed, to be the industry standard—the Palette has its shortcomings. The foremost deficiency is its resolution.

Polaroid Corp. designed the original Palette around the IBM Color/Graphics Adapter. When interfaced to the PC, it could not aspire to higher resolution than that adapter allows—even though the Palette itself was capable of resolving approximately 1,000 lines. Although the Palette used fancy tricks to add extra colors (from a choice of 72) and to sneak resolution up to 640 by 400 lines, it could never overcome the limit imposed by its composite

Because the Palette Plus is compatible with the software drivers used for the original Polaroid Palette, it already has a very large software base.

video interface on the CGA.

Introduced at Comdex in the fall of 1986, the Polaroid Palette Plus nearly dou-

bles the effective vertical resolution of the original Palette by adapting itself to the signals of IBM's Enhanced Graphics Adapter. Using software with a driver for the new Palette Plus, image resolution can be as high as 640 by 700 in full color. Even without the use of special software drivers, the new Palette Plus can put any EGA image on film—and can enhance its colors along the way.

Outwardly, little seems to have changed with the new Palette Plus. It still fits in the same shoebox-sized case. The display and film sections, too, are little altered. Hidden deep inside the beige-and-gray metal box is a 3-inch CRT. In front of the tube is a color wheel that alternately spins red, green, and blue filters.

The Palette Plus allows you to use three film formats and three different camera backs—35mm, 3¼- by 4¼-inch pack film, and 4- by 3-inch AutoFilm (integral developing print film like that used in SX-

A

Strategic Review
Market Share Leaders

- ■ 42.0%
- ■ 28.0%
- ■ 12.0%
- ■ 10.0%
- ■ 8.0%

GTB
Rett Inc
Exco
Formex
UOC Inc

Produced by ImageMaker™

B

PROJECTED MARKET SHARE

ACE, INC.
JOHNSON, INC.
CAPITAL CO.
ACME COMPANY
BROWN, INC.

Created with 35mm Express and the PalettePlus

C

Software Division
Quarterly Report of
Major Expenses

Rent/Utilities
10.6%

Taxes
13.4%

Equipment
19.4%

*A one time utilities charge of $12,000 has been included.

A SHARPER IMAGE

Your primary concern when purchasing an imaging system is its resolution: the higher the resolution the sharper the image. Of all the film recorders reviewed in this issue, the ImageMaker from Presentation Technologies provides the highest resolution. You can see what 8,000-line resolution looks like in the pie chart labeled A. The Palette Plus, which created slide B, outputs slides with the lowest resolution. The new Palette Plus uses software with a driver to adapt itself to the signals of IBM's Enhanced Graphics Adapter, resulting in image resolution as high as 640 by 700. The vector-based PhotoMetric 200PC, which created slide C, provides 2,000- by 2,000-line resolution and claims a color range of 1,000 different hues.

70- and Spectra-style cameras. The first two of these are included as standard equipment. In addition to ordinary and instant 35mm slides (color and black-and-white, high and normal contrast), the ImageMaker from Presentation Technologies provides the highest resolution. You can supports color and black-and-white instant print and not-yet-commercially-available Colorgraph overhead projection instant pack film.

The 35mm camera back, which you cannot remove and use as a normal camera, has motorized wind and rewind. The pack-film back is a plastic creation that fits only the Palette.

The Palette Plus attaches to your computer with a double connection. It receives data and instructions for changing colors through a serial connection and video information through an EGA connection. That is, you plug the Palette Plus into your EGA, then plug your monitor into the Palette Plus. In this way, the video signal

bound for your EGA display loops through the Palette Plus.

Because the EGA actively manipulates the signal on its way to your monitor (letting you preview the image much as it will be photographed), the film recorder must be turned on at all times when you want to see an image on the monitor, regardless of whether you plan on taking pictures.

Unlike the original Palette, the Palette Plus requires no setup adjustments. In lieu of the video threshold control used by the original Palette, the Plus has a zoom control that allows you to adjust image size by about 4 percent. In actual operation, little is changed with the upgrade to the Palette Plus.

TWO POLAROID PROGRAMS As in the older model, Polaroid supplies two programs to let you capture screens that are

generated by other software.

One of the programs, OneStep, is a memory-resident screen-grabbing program that also allows you to directly print the screen to the Palette Plus. At the same time, it also allows you to alter image colors, and, if you want, save the augmented image to disk. OneStep works one image at a time and will not batch process multiple screen files. Once it is loaded into memory, you call up OneStep by pressing a two-key combination (Ctrl and one other key of your choice). From then on, the program is menu driven and completely straightforward.

Polaroid's Palette program allows you to print to film images that have previously been saved by OneStep. It has batch processing capabilities, so you can program it to print enough images to fill a whole roll of film. Like OneStep, Palette also allows you the freedom to alter the colors of the

image that you're going to print.

Although the Palette Plus can record a screen image in less than 15 seconds, the process can take considerably longer if the images have been made by programs with special Palette drivers.

The Palette Plus comes as a complete system, including the basic film recorder, connecting cables, two camera backs, a power processor for Polapan and Polachrome instant 35mm films, and an illuminated slide mounter.

Because the Palette Plus is compatible with the software drivers used for the original Palette, it already has a large software base. With the Polaroid-supplied software, it can duplicate nearly any screen image on film (functioning as a screen camera), making it almost universally compatible.

● ●
PhotoMetric 200PC

The PhotoMetric 200PC, from General Parametrics Corp., bears a superficial resemblance to the Polaroid Palette, and yet it is distinctively different.

Inside, the PhotoMetric uses a CRT that measures about 3 inches diagonally, including its drive electronics and a color wheel, much as does the Palette.

Standard equipment includes a 35mm camera back that attaches to the front panel of the PhotoMetric using a mounting scheme identical to the Palette. The camera back itself, a remote-controllable, black, motorized auto-wind and rewind

Inside Outside

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9am PTZ
Sat 9 - 11am PTZ

mechanism that cannot be used as a functional camera, is also identical to that used by the Palette. A 3¼- by 4¼-inch Polaroid pack-film back is optional.

Conceptually and functionally, however, the PhotoMetric is entirely different. Moreover, the PhotoMetric promises a quantum improvement in quality.

While the Palette is basically a raster-based recorder, the PhotoMetric is vector based. It receives vector instructions from the software driver and converts that information to a raster image that is then photographed.

The PhotoMetric's resolution makes the Polaroid Palette Plus look amateurish in comparison. Not only is the PhotoMetric's CRT markedly sharper than that of the Palette, its beam width has been reduced by a factor of 2.2. Because of these and software improvements, the PhotoMetric claims a resolution of 2,000 by 2,000 lines, with a color range of 1,000 hues achieved by mixing ten different levels of each of the three primary colors.

PRODUCING QUALITY OUTPUT

you can set the input/output (I/O) port address of the General Parametrics adapter to any one of seven different values using three jumpers.

Because the PhotoMetric is essentially vector based, it is choosy about the images it makes and how it makes them. It cannot copy ordinary screens to disk.

As with previous General Parametrics products (which include a video presentation system, improved monitor displays, and a hard copy system), the PhotoMetric operates from images that have been stored in a special Video Show format, which corresponds to NAPLPS (North American Presentation Level Protocol Syntax, a VideoTex graphics standard). Compatible programs currently number about two dozen, including General Parametrics' own *Picture It* software, an easy-to-use text-and-chart slide maker.

The PhotoMetric control program, which operates the film recorder, is quite easy to use since it includes both menus and prompts. It allows individual slides to be exposed as well as multiple copies of slides or sequences. Your normal monitor can be used to preview the images to be recorded. However, the PhotoMetric system greatly improves on the normal IBM-standard image to give a nearly exact preview of the 2,000- by 2,000-line, 1,000-color film image.

As with most vector-based systems, exposure of extremely complex images can be quite time consuming. Moreover, because of limitations in the control software, intricate images may require multiple exposures of overlay files that stack detail upon detail in the finished slide. Images of average complexity should require several minutes of exposure.

Although the quality of the PhotoMetric 200PC is commendable, a few of its design details are not. For instance, its control program is copy protected—despite the fact that the software requires $5,000 of General Parametrics hardware to be at all useful. That's stupid. On the other hand, the image quality produced by the PhotoMetric is no less than superb, and the tiny size of the system makes it seem even more amazing.

Winn L. Rosch is a contributing editor of PC Magazine.

PRODUCING QUALITY OUTPUT:
The Service Bureau Option

If your business requires only a moderate number of high-quality slides or if you'd like some artistic help to enhance them, consider a service bureau. We take you on a guided tour of the offerings from various services nationwide.

If you have moderate needs for slide shows, you'll get high-quality output from a service bureau. But because the phenomenon of computer graphics service bureaus is still emerging, you'll find that each bureau has a unique charisma and baffling characteristics. Before you sign on, you should chart your own needs versus their offerings.

Some of the service bureaus, for example, offer their own name-brand PC-based graphics package as their low-end entry in a spectrum of computerized and noncomputerized photo services. Other bureaus are generic PC-based microcomputer graphics production houses and handle a variety of different software packages and output devices. Some services don't require PC-based graphics software at all—instead you can send them data, from which they will create graphics, via modem. And all are limited in the number of graphics packages they support. So, if you plan on purchasing a package with the hopes of using the services of a graphics bureau, be sure you can locate the bureau that supports your product before you buy.

To guide you through your choices, the following is a discussion of the things to watch out for and a sampling of some of the offerings available nationwide.

DEDICATED VS. INDEPENDENT The most well-entrenched services are evolutions of the high-end graphics workstation market. High-end workstation users ship their graphics to service bureaus for high-quality output. Some suppliers of standalone graphics workstations, realizing the untapped market for low-cost com-

puter graphics, have broadened their basic offerings to include PC graphics software that can use the same link to high-resolution output facilities.

These services are package specific. Since you must use their package, you may wind up with a graphics package that is less than ideal for your situation. On the other hand, you are buying into an established network of graphics expertise with a charted course toward upward mobility. Typically these networks supply some custom software designed to maximize the attractiveness of your graphic.

Third-party slide bureau companies are a more recent phenomenon. These may or may not be offshoots of larger, full-service photo bureaus. But they can work with data transmitted from a number of PC packages. While they can accommodate a greater number of packages, they offer fewer enhancements.

FINISHING TOUCHES Bureaus differ in the degree to which they accommodate requests for custom work. Some are "what you send is what you get" operations, simply turning around your graphic information into a slide. Others provide a spectrum of customization services. Some will archive your company's artwork, while others will place a company logo on the slide. Still others can create special effects such as zoom, drop shadows, star patterns, or special color schemes, and can insert a symbol or a freehand drawing. Others will help you concentrate on your presentation, offering pin registered slides for accuracy in creating overlays, build, and multiprojector sequences. Some service bureaus even provide the services of graphic artists to help you create a presentation.

TRANSMISSION METHOD All of the companies listed take either modem or disk transmission. Some allow you to specify enhancements on their on-line work order. Others require a phone call or written note.

GEOGRAPHIC SPREAD Service bureaus can be specialists in one location or they can offer centers nationwide. Thanks to Tymnet connections, geography won't influence your transmission of input and

PC-to-FAX

PRODUCING QUALITY OUTPUT

output, but it does influence turnaround time.

WHAT YOU SEE You may wish to preview the graphic image on your screen. Some services can display a full preview of your image. Others show text, but not the chosen fonts on your preview screen. The 3M Corp. offers a unique text-based service that eliminates the need for a PC graphics package, but it offers no preview capability.

RESOLUTION The computer image you view on your display screen has limited resolution; an EGA card gives 640- by 356-line resolution. But the film recorders used by service bureaus produce anywhere from 2,000- to 8,000-line resolution. The lower resolution is typically less expensive because it requires less image processing time. The standard is 4,000-line resolution which is approximately 36 times higher than the EGA's display screen resolution.

QUALITY SERVICE Regardless of quality or gee-whiz effects, a slide that isn't ready on time, or gets bent in the mail, won't impress any audience. Therefore, before committing yourself to a service, do a trial run. Slides should be delivered on time, carefully mounted and well protected in slide holders.

Don't merely hold a slide up to the light to check on its quality. Project it on the big screen and scrutinize. Check carefully for mistakes, such as lopped-off titles and mountings that cut into the lettering. Are the diagonal lines smooth or jagged; are the pies rounded; are the fonts legible; is the color palette attractive with vivid, deep, easy-to-read colors?

As you practice creating slides, you'll learn to create better slides by practicing the placement of information on the slide and experimenting with the use of color, fonts, and size. But while you are perfecting these talents, you'll want a service that makes the most out of your worst-case learning experiences.

A SERVICE BUREAU TOUR All computer graphics service bureaus give you the opportunity to use first-class equipment, but the rules and regulations vary. Here's a whirlwind tour of what's available.

that produce such intricate graphics as 3-D, texture mapping, and reflections, as well as free-form drawing.

Art Machine will accept a disk (not telephone transmission) of data generated by any of the packages it sells and will output the information to either its Matrix QCR or Matrix PCR film recorder. Services similar to Art Machine's are available in most major U.S. cities, according to an Art Machine spokesperson.

●● Autographix

Autographix develops, manufactures, and markets graphics systems, software, and imaging services. Autographix's *Slide Expert* (reviewed in this issue) and *Autographix 35 Presentation Graphics Software* are PC based and are upwardly compatible with sophisticated Autographix workstations. Images created with these packages can be transmitted to and enhanced at any of four regional Autographix Imaging Centers.

You transmit the image to the Imaging Center via modem using a communications component built directly into the Autographix software. Next-day service is standard with Autographix. Imaging centers output to 4,000-line Celco film recorders, Autographix laser printers, and Autographix color thermal printers. Output includes slides, prints, tabs, overhead, and printed documentation.

PC users can preview the image onscreen if they choose, but all text and data is translated to high-quality fonts once it arrives at the Autographix Imaging Centers. Autographix offers the convenience of credit card billing.

●● AZTEK

Aztek offers a complete computer art service originally for Hewlett-Packard main-frames and more recently available to PCs. The company's high-end PC product, called *The Studio System*, sells for $46,000. Its entry-level program, *PCchart* (reviewed in this issue), allows you to gen-

9:02: *"A database manager? How many months will this take?"*

12:04: *"Wow, my first report. And there's still time for lunch."*

2:19: *"From now on I'm taking the easy way out."*

PRODUCING QUALITY OUTPUT

erate simple charts and graphs. *PCchart* contains a telecommunications component that links to an Art Center location. Independently operated Art Centers are located throughout the country.

Because *PCchart* outputs to a number of high-end film recorders, you have a greater choice of bureaus. Many of the Art Centers supply the software at minimal cost in order to promote their slide business, both computer and otherwise.

For example, at Allen Photo (Arlington, Virginia), an Art Center location for *PCchart*, you send chart information via modem or disk to the bureau. A PC receives the image and sends it to an HP 1000 that then displays your graphic on its 1,000-line monitor. At this point, the company will make any requested enhance-

> Many of Aztek's Art Centers supply *PCchart* software at minimal cost in order to promote their slide business.

ments for an extra charge. The HP system can even create animation for multi-image shows. Output is sent to a Lasergraphics unit (to speed up recording), then to a Matrix QCR, and is finally photographed with a pin registered camera. This Center is a division of a larger photo lab.

PRODUCING QUALITY OUTPUT

Brilliant Images

Brilliant Images' Computer Picture Service is unique because the service supports ten popular graphics packages. Brilliant Images accepts data sent on a disk or via modem using any standard telecommunications package, and, in fact, is the only service that can accommodate MCI Mail. This makes it a viable link for those outside of the New York area. In addition, you can ship data around the clock, and slides are

> Brilliant Images accepts data sent via modem using a standard telecommunications package and is the only service that accommodates MCI Mail.

delivered within 24 hours.

Based entirely on personal computer technology, Brilliant Images uses a number of film recorders and laser printers as output devices and is capable of producing

slides, overheads, and 8 by 10 transparencies or printed handouts.

In addition to reprographic services, Brilliant Images offers a full range of graphics services, including custom effects, logos, consultation, and training. A staff of artists offers custom graphics service to enhance PC-generated images. Brilliant Images is the only service we came across whose sole business involves microcomputer graphics production from PC software. Expect more of these in the future.

Data Color Graphics

Data Color Graphics is a full-service film lab that is expanding into the field of PC-based slide production. Data Color views computer graphics slide production as a logical extension of its work. It has acquired a number of PC packages and is expanding its support for additional PC-based graphics packages based on user requests and on the company's ability to tweak and tune the connection between a package and the film recorder.

Data Color Graphics uses a Matrix QCR and accepts input from any PC business software package that supports the Matrix QCR as an output device. Unlike some of the other "4,000-line" bureaus, Data Color normally provides 2,000-line-resolution slides. The lower resolution can be processed more quickly and is less ex-

Data Color Graphics provides 2,000-line-resolution slides, less expensive yet virtually indistinguishable from 4,000-line.

pensive, yet is virtually indistinguishable from 4,000-line.

Currently, Data Color does most of its work with floppy disks instead of phone lines. It believes that users think phone transmissions introduce too many errors. The company offers a walk-in or mail-in business. Currently there is little support for customization or enhancements, but the company says it will accommodate other arrangements as the need arises.

Genigraphics

Genigraphics has long been the leader in VAX-based graphic imaging. *Grafime* for the PC (reviewed in this issue) provides a low-cost link to the extensive Genigraphics imaging network. *Grafime* uses preformatted templates for creating graphs and charts and provides a form for you to fill out, in which you specify enhancements, quantities, and output desired. A *Grafime* utility converts the file to a metafile of information to be transmitted via

modem. Any standard communications package transmits the file to any of 25 Genigraphics Service Centers. The Virtual Device Metafile provides upward compatibility with Genigraphics 100 series

workstations and its PS and Masterpiece Series film recorders. Turnaround is typically 24 hours using Federal Express. The Genigraphics film recorders have resolutions from 2,000 to 8,000 lines.

GIANT KILLER.

MAGICorp

MAGICorp offers a software-independent process for the production of slides, transparencies, and prints. The company holds the patent on the transmission of graphic information over the telephone for the production of ultra-high resolution photographic images, and its software is free to those with packages that support MAGICorp output. It licenses this technology to a number of other computer slide bureaus.

To use any package supported by MAGICorp, you must open an account with the company and install and select the MAGIComm driver as an output device. This lets you save graphics as a graphic metafile. The MAGIComm installation procedure includes an on screen work order asking you to specify items such as the type of output and quantity desired. This information is transmitted to one of MAGICorp's three Production Centers, which use a Perkin Elmer minicomputer to recompute the transmitted image and output to a $225,000 Celco film recorder with 4,000-line resolution.

Management Graphics

Management Graphics is a full service computer graphics production house and has a variety of standalone and networked graphics workstations. *Personal Business Slidewire* is a PC-based graphics software that can produce basic charts, text, free form and symbol library art on a PC, AT, or XT. The output is sent via a built-in telecommunications link to one of 26 multinational Graphic Network Service Centers.

Members of the Graphic Network are independently owned and operated slide production houses of photo lab centers. Network members distribute MGI soft-

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CIRCLE 349 ON READER SERVICE CARD

ware and offer imaging of slides through MGI's *Quickchart* slidemaking software. The PC software is upwardly compatible with Management Graphics' higher-end minicomputer-based *TTS/Plus, TTS/Tri-Master,* and *QM-1 Quickchart* slidemaking systems. The data is enhanced and output to 4,000-line film recorders. MGI offers full service output including slides, transparencies, and printers.

3M Meeting Graphics

If the thought of creating your own Picasso pie charts is unappealing, then consider 3M's MGS+ service. You never have to deal with the graphic image. Instead you specify the data input and the desired output through a work order.

3M service is easily accessed via a Tymnet connection. The process is simple. You call up a bulletin board, and after securing a password, you answer a series of on-screen prompts to specify your graph. Once the information is entered into the 3M computer it is downloaded to a production computer and output to a 4,000-line Celco film recorder.

The size of the per-slide fee will vary with the intricacy of the slide. Geared to small businesses that don't want to get heavily involved in the creation of the graphic, the service is easy to use yet offers a good smattering of interesting special ef-

fects and the ability to build slide sequences. Those with a PC but no graphics software of their own can find a satisfactory solution with 3M's service.

Robin Raskin is a frequent contributor to PC Magazine.

![PC Magazine] PRODUCTIVITY

■ **PC LAB NOTES:** A DOS TUTORIAL ■ ETHAN WINER

DIGGING DEEPER INTO DOS, PART 2

In this concluding installment, you'll learn about using ANSI.SYS, advanced uses of the DOS environment, and 3.2's fast and versatile XCOPY.

The first part of this article (PC Lab Notes, Volume 6 Number 4) covered commands—and the variety of options many of them accept—that were introduced with DOS, Version 2. In this issue I'll discuss some of the less obvious and less frequently used DOS commands and then conclude with the features that are unique to DOS 3.

THE THREE Vs Although the COPY command will accept a /V option that causes it to verify the integrity of a specific copy operation, the VERIFY command allows you to enable this useful feature until you reboot. Note that VERIFY may be entered directly from the command line or in a batch file. It can also be placed within your AUTOEXEC.BAT file. You can turn the VERIFY command on or off, as shown below:

```
VERIFY ON
```

or

```
VERIFY OFF
```

If VERIFY is entered on the command line with no arguments, DOS will report whether it is on or off, as it does with ECHO.

Entered at the DOS prompt, the VER command reports which version of DOS is currently running, and VOL displays the volume label for a disk, if it has one. Entering VOL alone checks the disk in the default drive, though of course any drive may be specified, as in

```
VOL B:
```

BREAK Normally, DOS checks to see if Ctrl-Break was pressed only when it goes to the keyboard for input or sends characters out to the display screen. But by entering the command

```
BREAK ON
```

you tell DOS to check for the break key even while a program is running. One interesting feature of BREAK is that it may be entered from the DOS command line or a batch file, or may be placed within CONFIG.SYS. Like VERIFY, if entered from the command line without ON or OFF, DOS will report the current Break status. Most users would do well to avoid the

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Exploring hidden DOS features.

PROGRAMMING/UTILITIES
ASC.COM pops up a full ASCII chart over running applications programs.

SPREADSHEET CLINIC
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TURBO POWER USER
A patch for 3.02A and tips on string searches and I/O choices.

PC TUTOR
The .EXE format explained and a warning on using DEBUG to alter directory information.

BREAK option, which is mainly intended to allow programmers to break out of an unsuccessful compile or from a program assembly.

PROMPT You're much more likely to use the internal DOS command that lets you change the normal A> or C> prompt into nearly anything you'd like. Two of the most common applications of the PROMPT command involve displaying the current drive and directory and setting various screen attributes through ANSI.SYS. I'll get to that second one in a moment.

The general format of the PROMPT command is

```
PROMPT string
```

where *string* may consist of nearly any text or message you would like displayed. However, DOS provides a set of codes that simplify customizing the prompt. For example, besides showing the current drive or directory, PROMPT can also display the date or time, or the DOS version.

The complete list of available codes is given in your DOS manual, but some of the more interesting ones are shown below. PROMPT's special control codes are indicated by preceding each with a dollar sign. To show the current path followed by a greater-than (>) symbol, use

```
PROMPT $p$g
```

To show the current date, time, and drive on separate lines:

```
PROMPT $d$_$t$_$n$g
```

■ PC LAB NOTES

(The underscore code means go to the next display line.)

Many of the things PROMPT can do are downright frivolous, and two of my personal favorites are shown below:

```
PROMPT  B$g
```

(Enter the "B character by holding down the Ctrl key while striking the letter B.)

And for grins, try this one too:

```
PROMPT  YoYo$hoo$ho$h
```

For clarity, all of the repetitions for this PROMPT command are not shown above. After the initial PROMPT YoYo, enter 13 groups of Shoo, followed immediately by 12 groups of ShoSh. Trust me, it will be worth the trouble.

MORE ON ANSI.SYS In Part 1 I discussed the use of ANSI.SYS in writing programs for PC "not-so-compatibles." But there are so many other things that the ANSI driver can do once you have installed it in your CONFIG.SYS file (see the sidebar "The DOS 3 CONFIG.SYS") that it has essentially become a complete programming language in and of itself. Unfortunately, IBM buried the information about ANSI.SYS in the DOS *Technical Reference* manual, to which few users have access. Figure 1, together with the discussion that follows, will rectify that situation.

The two main purposes of the ANSI.SYS device driver are to intercept special codes on their way to the display screen and to allow most of the keys on the keyboard to be redefined. While not nearly as convenient to use as Borland's *SuperKey* or RoseSoft's *ProKey*, keyboard macros can be defined and used with ANSI.SYS, though only to a point. Many programs (such as Lotus's *1-2-3*) bypass DOS completely for keyboard input, and instead go directly to the BIOS or hardware ports. Those applications will not be affected by any key reassignments made through ANSI.SYS, since these changes affect DOS's input routines only.

All of the control codes that ANSI.SYS recognizes begin with the Escape character (hex 1B or decimal 27), followed immediately by a left bracket ([) and then by one or more numbers and/or letters. When multiple parameters are being entered, they

THE DOS 3 CONFIG.SYS

Besides the environment variables, DOS 3.2 maintains a wealth of additional internal information via statements that have been placed in CONFIG.SYS. Some of these new capabilities are very powerful and, consequently, quite technical in nature. A good example of DOS 3's sophistication is the SHELL statement, which allows specifying an alternate command interpreter, as opposed to COMMAND.COM.

The normal COMMAND.COM, for example, would not be appropriate for PCs such as those produced by Hewlett-Packard. In such machines, instead of using a command line, the entire operating system is based on HP's unique touchscreen interface. Similarly, a software developer might wish to create a self-booting system in which COMMAND.COM was not needed. Rather than require an AUTOEXEC.BAT file bring up the application, the developer could include the name of an alternate top-level processor within CONFIG.SYS, and it would gain control during the boot process.

SHELL Specifying a replacement for COMMAND.COM is done with the SHELL statement, whose syntax is

```
SHELL = ALTERNAT.COM /P
```

Notice that since DOS maintains the name of the current command processor in the environment, it is essential that the replacement program be identified. Otherwise, when some programs terminate, the message "Insert COMMAND.COM disk" will be displayed, even though that is not the correct program to use. You inform DOS of this by using SET COMSPEC, normally in the AUTOEXEC.BAT file.

```
SET COMSPEC = C:\ALTERNAT.COM
```

SET COMSPEC may also be used to tell DOS to look for COMMAND.COM in a place other than where the system was booted from. On a two-floppy system, it is a nuisance to have to insert a DOS disk in drive A: when some programs terminate. If you instead create a RAMdisk as drive C: at boot time and copy COMMAND.COM to it, this will never occur. (Although SET COMSPEC is supposedly usable in DOS 2, a bug in that version prevents SET COMSPEC from working correctly.)

Additional options when using SHELL as an entry in your CONFIG.SYS file allow you both to specify the amount of environment space to be set aside and to designate that the replacement is to be permanent. In fact, even though the discussion so far has centered on using SHELL to specify a COMMAND.COM replacement, it can also be used with the normal COMMAND.COM simply to expand the amount of memory reserved for environment variables. The example below will set 512 bytes of environment space:

```
SHELL = C:\COMMAND.COM /E:512 /P
```

The /P option is needed to indicate that the specified setup is to remain permanently in memory, and also to run the file AUTOEXEC.BAT when it first begins.

DRIVER.SYS Another DOS 3.2 jewel is the DRIVER.SYS device driver. As explained in Part 1, alternate hardware driver programs may be specified by including their names within CONFIG.SYS. But DRIVER.SYS is intended to solve a very different problem.

Many PCs that are equipped with a hard disk have only a single floppy drive. On those occasions when a floppy-to-floppy copy is required, DOS is smart enough to realize that any reference to drive B: must actually be routed to drive A:. And, of course, DOS always gives you a chance to swap disks whenever this "logical" drive has changed.

But what if you have a PC AT with both A: and B: drives and you need to copy a single file from one 1.2-megabyte disk to another? There's no problem us-

ing DISKCOPY, because it already supports changing drives in the middle. But before DRIVER.SYS, you couldn't ask DOS to pause while you swapped diskettes to copy to the same drive.

Like SUBST and JOIN, DRIVER.SYS lets you create an alternate identifier for a particular drive. If you have a PC AT with A: and B: floppies and a C: hard disk, you could refer to drive A: as drive D: by using the statement in Figure A. Let's look at each option in turn.

The first step is to inform DRIVER.SYS which drive is being aliased. This is done with D:/0, where the zero means drive A: (Had you wanted to specify drive B:, a 1 would be used; 2 would mean drive C:, etc.) Next, the number of tracks drive A: has must be specified (/T:80), followed by the number of sectors (/S:15) and the number of drive heads (/H:2).

Though DRIVER.SYS is intended for use on any of the machines in the PC family, the /C option is appropriate only on an AT or compatible. (The drives in these machines contain extra hardware that can detect when the drive door has been opened and the disk changed.) Finally, /F:1 tells DRIVER.SYS the type of drive it is dealing with (0 means single- or double-sided 180/360K, 1 indicates 1.2-megabyte capacity, and 2 is for the 3½-inch 720K types).

FILE CONTROL BLOCKS The FCBS statement is yet another configuration option new to DOS 3.2. It lets you accommodate older programs that were written using the File Control Block method of file access.

Before DOS 2 came along, it was up to the programmer to create an area in memory called a File Control Block (FCB), to hold information about a file. This is a tedious and thankless task that is not for the fainthearted. Fortunately, the current DOS versions allow assembly language programmers to refer to a file by name, which is much easier.

```
DEVICE = DRIVER.SYS /D:0 /T:80 /S:15 /H:2 /C /F:1
```

Figure A: A CONFIG.SYS entry to allow referring to drive A: as drive D:.

The naming method, besides being simpler to implement, also requires less system memory. But these older programs—especially database applications—often require many files to be in use at once. As part of its normal service, DOS must keep track of how many files are currently in use and ensure that a program doesn't attempt to open more than can be accommodated by the memory set aside for this purpose. If this happens, DOS has no recourse but to close those that were opened earlier before opening the new ones. The syntax for FCBS includes two parameters:

```
FCBS m,n
```

The first number tells DOS how many total files may be in use at one time, and the second how many must remain open regardless of what a program requests. Since DOS may need to close a file without the approval of an application, some means of forcing certain critical files to remain open is needed. If, for example, the first file that is opened contains context-sensitive help, then it should never be closed without permission. If only one file must be protected in this manner, then the second parameter will be 1. If two files must always remain open, then 2 would be used instead.

Along with some wonderful new features come a few headaches as well. The handling of hardware interrupts has been completely revised in DOS 3.2, and unfortunately, it is now up to the programmer to ensure that enough memory for the system stack has been set aside. This is done with the STACKS statement.

STACKS Each time a hardware interrupt occurs (such as a key being struck, or a COM port indicating that information is being received), the currently running program is suspended and control is passed to a particular interrupt handler.

But DOS can't just drop what it's doing willy-nilly. Before it can interrupt one program to execute another, certain critical information must be saved. This includes the contents of the CPU's variable registers, segment registers, and flags. These are saved in an area of memory called the stack. Since one interrupt routine can also be interrupted by another (a key is pressed at the same time that a signal comes in the COM port), multiple stacks must be maintained.

The STACKS statement takes two arguments—the first is the number of separate stack areas to set aside, and the second contains the size in bytes of each stack. If you don't have a STACKS statement at all, DOS defaults to nine stacks, with each holding 128 bytes. To create this to, say, 20 stacks of 256 bytes each, you would include in your CONFIG.SYS the statement

```
STACKS = 20,256
```

Of course, nothing comes for free, and for each byte you dedicate for use as a stack, that much is taken out of RAM.

GOING BEYOND E: The final DOS 3.2 CONFIG.SYS statement to consider here is LASTDRIVE, which allows you to specify the number of phantom drives that may either be SUBSTituted or created with VDISK. Normally, memory is set aside within DOS only to accommodate drives A: through E:. However, if you intend to have many RAMdisks, then their drive letters will undoubtedly extend beyond E: For example, in a three-drive system (A: through C:) that has three RAMdisks and five substituted drives, a total of 11 drive identifiers will be required. Therefore, if this is to work, you must include the statement

```
LASTDRIVE = K
```

in CONFIG.SYS.—**Ethan Winer**

■ PC LAB NOTES

must be separated by a semicolon.

The complete list of codes that the DOS ANSI.SYS recognizes, and their resultant action, are given in Figure 1, but to implement any of these commands, the codes must be sent to the display screen. For a programmer, this is easy—you just use the PRINT statement in BASIC, Write in Pascal, or Printf in C language. But how can the rest of us accomplish this?

When many codes are to be sent (for example, to create a number of keyboard macros), one method is to put them into a text file and then TYPE that file as part of the AUTOEXEC.BAT start-up sequence. In the process of sending the codes to the screen, ANSI.SYS will receive and act upon them.

The other method is to include the codes as part of a DOS PROMPT customizing command, so they will be generated each time a program terminates. When ANSI.SYS is being used to create screen colors, this is the most effective procedure, since many programs alter the display when they run.

Because ANSI.SYS can be used to control the screen, many interesting and useful tricks are possible. Using PROMPT, for example, ANSI.SYS can be instructed to save the current cursor position, set the foreground and background colors, then locate the cursor in the upper-right-hand corner to display the date and time, restore the color to black and white, and finally return the cursor to the bottom left and display the current drive. The possibilities are endless, as evidenced by the continuing User-to-User submissions on the subject. [*Readers may also want to look at the PC Tutor in Volume 6 Number 3.—Ed.*]

Three examples will illustrate the use of ANSI.SYS. The first reassigns function keys F1 through F4, using a TYPEd file. The second displays the date and time as just described above. And the third combines the effect of the first two, but as a single AUTOEXEC.BAT file.

Reassigning keys requires knowing their ASCII codes or, for extended keys (e.g., the function keys), their keyboard scan codes. This information is listed in an appendix at the back of the BASIC user's manual. Note that when an extended key is being substituted, a two-number code is used, and the first number is always a zero.

To put the ANSI.SYS codes into a file, you'll need a text editor that allows entering the Escape character. A few word processors (e.g., *XyWrite*) allow you to do this directly. I usually use Borland's *SideKick* because it accepts any control code and is always available with a single key. To enter the Esc key within *SideKick*, first press Ctrl-P (for printer code), and then press Esc.

For clarity, each of the sample function key reassignments are shown on a separate line, though they could just as easily be entered as one long string with no separating spaces. Refer to the ANSI codes in Figure 1 as you follow along.

The function keys will be assigned thus:

```
F1 = "Dir A:" + <Enter>
F2 = "Dir B:" + <Enter>
F3 = "Copy "
F4 = "Type "
```

```
----- CURSOR POSITIONING COMMANDS

Cursor Locate:        <Esc>[#;#H

                      The first number specifies the row to go
                      to, and the second specifies the column.
                      If both numbers are left out, the cursor
                      goes to the home position.

Cursor Up:            <Esc>[#A

                      The number specifies the number of rows.
                      If the number is omitted, the cursor is
                      moved up by only one row.

Cursor Down:          <Esc>[#B

                      The number specifies the number of rows.
                      If the number is absent, the cursor moves
                      down by only one row.

Cursor Forward:       <Esc>[#C

                      The number specifies how many columns to
                      advance, but will not go past column 80.
                      If the number is left out, the cursor
                      advances by one column.

Cursor Backward:      <Esc>[#D

                      The number indicates how many columns to
                      go backward, but will not wrap around
                      before column 1.  If the number is
                      omitted, the cursor moves one column.

Cursor Save:          <Esc>[s

                      This causes the current row and column to
                      be saved in memory.

Cursor Restore:       <Esc>[u

                      This locates the cursor at the position
                      it was when the most recent Cursor Save
                      was used.

                                                       (continues)
```

Figure 1: *The DOS ANSI.SYS command control codes.*

```
----- CLEAR DISPLAY COMMANDS

Clear Screen:      <Esc>|2J

                   This command clears the entire screen,
                   and places the cursor at Row 1, Column 1.

Clear Line:        <Esc>|k

                   This causes the current line to be
                   cleared from the current cursor position
                   to the end. The character at the cursor
                   position is also cleared.

----- GRAPHICS AND COLOR COMMANDS

Set Colors:        <Esc>[#m or <Esc>[#;#m or <Esc>[#;#;#m

                   The number of parameters may vary, and
                   their meaning is as follows:

              0    restore colors to white on black
              1    high intensity
              4    underscore on (monochrome only)
              5    blink on
              7    inverse video on
              8    invisible on
             30    Black foreground
             31    Red foreground
             32    Green foreground
             33    Yellow foreground
             34    Blue foreground
             35    Magenta foreground
             36    Cyan foreground
             37    White foreground
             40    Black background
             41    Red background
             42    Green background
             43    Yellow background
             44    Blue background
             45    Magenta background
             46    Cyan background
             47    White background

----- MODE SETTING COMMANDS

Set screen mode:   <Esc>|=#h

                   The number indicates which video mode is
                   to be activated, using these choices:

              0    40 x 25 black & white text
              1    40 x 25 color text
              2    80 x 25 black & white text
              3    80 x 25 color text
              4    320 x 200 color graphics
              5    320 x 200 black & white graphics
```

(Figure 1 continues)

To make the reassignments, the following commands are placed in the file KEYS .SET that is typed:

```
<ESC>[0:59;"DIR A:";13p
<ESC>[0:60;"DIR B:";13p
<ESC>[0:61;"COPY "p
<ESC>[0:62;"TYPE "p
```

The first line begins with getting ANSI- .SYS's attention with the Escape character and left bracket. Then, F1 is specified with 0;59 followed by the quoted text that is to be output each time F1 is pressed. Finally, the Enter key is indicated with the number 13, and the lower case "p" tells AN- SI.SYS that the preceding was a key reas-

■ To put the ANSI.SYS codes into a file, you need a text editor that allows entering the Escape character. I usually use *SideKick*.

signment command. The remaining lines continue the key substitutions for function keys F2 through F4.

To embed ANSI codes within the PROMPT command requires taking a different tack. In this case, a batch file will be used. Figure 2 shows the sample contents of PRMPT.BAT for use on a color-equipped PC.

First the current cursor position is saved with <Esc>|s. Then the display colors are set to blue on red with <Esc>[34;41m. <Esc>[1;50f locates the cursor on line 1, at column 50, and $d and $t displays the date and time. Notice that $d and $t are part of the PROMPT command repertoire, and have nothing specifically to do with ANSI.SYS. I've included a single space between the $d and $t to improve their readability. The color is then restored to normal white on black with <ESC>|0m, and the cursor is repositioned to where it had been with <ESC>|u. Finally, the PROMPT command ng displays the

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usual drive and greater-than symbol.

If you're using a monochrome system, you may wish to change the "colors" to, say, highlighted and underlined by replacing `<Esc>[34:41m` with `<Esc>[1:4m` instead.

To combine these examples into something you might put in your AUTOEXEC .BAT file requires simply that the function key assignments be ECHOed to the screen. As you can see, this is not difficult, though you must bear in mind that *how* you generate the code shown as `<Esc>` will vary with your word processor or editor.

```
&:ECHo <Esc>[49;"U59 A;"¡13}
ECHo <Esc>[¡68;"U59 A;"¡13}
ECHo <Esc>[¡59;"GUP1 up "
&LC59; &so <Esc>[:"Y$95.5
PROMPT $t&<Esc>[<34;41r-Esc>[1;50;Sd
$t<Esc>[&<-Esc>[u$n$g
```

In DOS, to enter the Escape code, hold down the Alt key, hit 155 on the numeric keypad, and then release the Alt key. See Figure 2 for PROMPT line.

REDIRECTING OUTPUT Normally, you use the keyboard to enter information into the PC. Likewise, when your PC has something to say, it uses the display screen. However, it is a simple matter to specify an alternate input or output source when needed. This concept is called redirection, and it opens the door to many interesting possibilities.

Consider the lowly DIR command. If you want to get a printout of a directory, while you could always use the Ctrl-PrtSc combination, this would also print your original command. Try this instead:

```
DIR > PRN
```

The greater-than (>) symbol *redirects* the output of the DIR command to the printer. If you have two printers and would like to use the second, you would instead enter

```
DIR > LPT2:
```

Redirection also works with disk files, thus:

```
DIR > LISTFILE.TXT
```

Even if no such file as LISTFILE.TXT exists when you type this command, DOS will create it for you and then place the filenames there. If a file by that name already exists, DOS will first erase it before placing the filenames there. If you should

```
           6    640 x 200 black & white graphics
           7    cause character wrap at end of line

Reset screen mode:   <Esc>[#I

                     Same as Set mode commands, except that
                     parameter 7 disables character wrap,
                     causing any characters that continue
                     beyond the end of the line to be ignored.

----- RE-ASSIGNING THE KEYBOARD COMMANDS

The general form of this command is:

                     <Esc>[#;#p
                     Where the first number indicates which
                     key is being re-assigned, and the second
                     indicates what it is to be replaced with.
                     Both numbers are specified using their
                     ASCII codes.

Replace a single key with a string of characters:

                     <Esc>[#;"Your message here"p

Both string literals and ASCII code numbers may be freely
intermixed, for example to include a carriage return:

                     <Esc>[#;"Another silly message";13p

Extended keys are represented by two numbers--the first is
always 0, and the second is the key's scan code:

                     <Esc>[0;68;"F10 types this message"p

                                                         (Figure 1 ends)
```

```
PROMPT <Esc>[s<Esc>[34;41m<Esc>[1;50f$d $t<Esc>[8m<Esc>[u$n$g
```

Figure 2: A one-line batch file for color PCs that uses ANSI codes in the PROMPT command.

want to keep the contents of LISTFILE and merely append the new information to the end of it, all you have to do is use two redirection symbols, thus:

```
DIR >> LISTFILE.TXT
```

Redirecting input is just as easy and, as you might imagine, reverses the orientation of the symbols. This has become a very popular way for programmers to enter programs into DEBUG, since it can eliminate a lot of repetitive typing. If a program is prepared outside of DEBUG first, it can

be assembled simply by redirecting the file like this:

```
DEBUG < PROGRAM.ASM
```

If changes need to be made, then the file can be brought into your text editor, modified, and redirected into DEBUG all over again.

One caveat to observe when using this procedure is that *all* of the requisite commands must be in the file being used for input, including DEBUG's final Quit command. Since you're telling DEBUG that

CAD FOR THE NEXT GENERATION.

Actual screen images.

XCOPY—THE DOS 3.2 TREASURE

Sometimes a new DOS version isn't much of an improvement over the previous one. At other times, however, the new DOS version contains a real gem. The XCOPY command in DOS 3.2 is one of these gems. XCOPY is an extended COPY command that includes some of the features of BACKUP as well.

First, XCOPY is fast. XCOPY reads from the source disk as many files as will fit into memory, and only then writes the files out to the destination disk. COPY, on the other hand, reads and writes each file individually, continually switching back and forth between the drives.

Used with its optional /S switch, XCOPY will also copy files from nested subdirectories, creating any necessary new subdirectories on the target disk. While subdirectories are more common on hard disks than diskettes, you may have encountered some diskettes with subdirectories. XCOPY is excellent for making a copy of such a diskette, with

    XCOPY A:*.* B: /S

or for copying all the diskette files to a subdirectory of your hard disk while maintaining the same directory structure:

    XCOPY A:*.* C:\SUBDIR /S

where SUBDIR is a subdirectory of your hard disk.

Similarly, if you need to copy a directory of your hard disk (including subdirectories within just that directory) to a diskette, XCOPY is ideal:

    XCOPY C:\SUBDIR*.* A: /S

Sometimes you may want to copy only selected files from one disk to another. You could use COPY for each of these files individually, or you could use the /P (prompt) switch with XCOPY:

    XCOPY C:\SUBDIR*.* A: /P

In this case, XCOPY will ask on a file-by-file basis whether you want to copy the file. You need only type a Y or N for your answer. Of course, you can use the /S and /P switches together.

XCOPY is also useful for making backups. The /D switch followed by a date only copies files created or changed on that date or later:

    XCOPY C:\SUBDIR*.* A: /D:4-15-87

only copies to A: those files created or changed on or after April 15, 1987.

Another aid in backing up files is the file "archive" bit. The archive bit is part of the file attribute. It is set to 1 when the file is first created and every time it is changed. When you use XCOPY with the /M parameter, XCOPY will only copy files with an archive bit of 1. When

> ■ Used with its /S switch, XCOPY will also copy files from nested subdirectories.

it copies the file, it will set the archive bit to 0. The next time you use XCOPY with the /M parameter, that file would not be copied unless it had been changed in the interim.

You can thus use XCOPY to back up your hard disk with the command:

    XCOPY C:*.* A: /S /M

When drive A: runs out of space, simply put in a new diskette and rerun the command. Those files already copied will not be recopied to the next diskette.

The advantage of using XCOPY instead of BACKUP for this chore is that the copies on the diskette remain normal, usable files. Copies made with BACKUP must be restored using RESTORE before they are usable again.
—Charles Petzold

Charles Petzold is a contributing editor of PC Magazine.

its input is to come from this file, the keyboard will be completely ignored for as long as DEBUG is running. If anything is left out, there will be no recourse but to reboot.

Another important consideration when using redirection is that only those programs that use DOS for input and output will be affected. For example, Lotus's 1-2-3 completely ignores DOS in this regard, instead writing directly to display memory and reading keystrokes through the BIOS. Consequently, if you call up 1-2-3 using the redirection symbol, it will have absolutely no effect.

You can also take the output of one DOS command and redirect it into the input of another. This is called piping, and several programs are included on your DOS system disk that take advantage of this feature.

For example, to get a sorted directory listing to a printer requires three steps rather than two, as shown below. First the DIR command is given, then its output is redirected into the SORT program, and then finally it is sent to the printer.

    DIR | SORT > PRN

In this case, the vertical bar indicates that the destination of the DIR command is not to go into a file named SORT, but rather is to become input for a program named SORT. The usual redirection symbol that follows SORT then indicates that its output is to go to the printer. Had you instead entered

    DIR > SORT > PRN

DOS would have politely but firmly informed you of your error.

The MORE program is another DOS utility intended to be used with redirection. In DOS terminology such programs are called filters, since they modify the flow of data through a sequential chain of commands.

While the DIR command has the /P option to wait when the screen becomes full, TYPE has no such counterpart. It would be wonderful if we could simply say

    TYPE filename /P

but that just doesn't work. What will work, however, is to pipe the output of TYPE through the MORE filter, and let it take

care of pausing and prompting for a keypress.

```
TYPE filename | MORE
```

Again, the vertical bar is used so that the output of TYPE does not end up in a file named MORE.

One clever use of redirection is to suppress the extraneous messages DOS insists on displaying. Suppose you are creating a batch file that will install a series of programs onto a hard disk. Even if the batch file begins with the ECHO OFF command, the message "1 file(s) copied" will be displayed on the screen after each program is transferred. If you instead redirect the output of the COPY command to the reserved device NUL, then the messages will not be displayed.

The correct form is

```
COPY A:*.* C: > NUL
```

It may not be immediately obvious that COPY has any output other than the very act of duplicating a file, though if you think about it, it makes perfect sense. Sensibly, too, even when a command is redirected this way, any error messages will still go to the display screen. Thus, if you leave a drive door open, the familiar "Abort, Retry, Ignore?" message won't end up in a file or be disregarded when redirection to the NUL device is being used.

You might be tempted to think that copying to NUL could be used as a means to test the integrity of one or more disk files. It would seem logical to believe that if you entered

```
COPY A:*.* NUL
```

then each file would be read in turn, and if one of them were bad, DOS would tell you about it. In theory, it's a great idea, because it takes much less time to merely read a file than to actually copy it somewhere. However, the sad fact is that this simply doesn't work. I don't know what DOS is doing when you tell it to copy a file to NUL, but repeated experiments on a bad disk failed to produce an error, no matter which version of DOS I tried.

One of the most powerful uses of redirection is the little-known DOS CTTY command. I'll cover the basics here, but for a fuller treatment you should refer to

Stephen Manes's excellent article in the March 5, 1985, issue of *PC Magazine* (Volume 4 Number 5).

Whereas the usual redirection symbols remain in effect only for the duration of the program invoked with them, CTTY lets you reassign your input and output more or less permanently. One limitation with CTTY, however, is that both input and output must be reassigned to the same device. If you want to operate your PC from a room or across town, this is no problem; you just use the COM port for input and output and enter from the DOS prompt

```
CTTY COM1
```

Once you invoke CTTY from the DOS prompt, however, there is no easy way to remove it, for anything you enter at the keyboard becomes literally a dead letter. Unless the remote device you have assigned is itself capable of calling CTTY and specifying the CONsole, your only recourse is to reboot. What you can do, though, is to run CTTY from a batch file, and then have the same batch file cancel it later. Here's an example of a .BAT file that will do the job.

```
ECHO This message goes to the display screen
CTTY COM1
ECHO This message is sent out the COM port
do something here
CTTY CON
ECHO This message shown on the display screen
```

Whatever you do, don't try to Ctrl-Break out of a batch file like this one. If you do, DOS will ask you, "Terminate batch job? (Y/N)," and you'll have no way to respond!

DOS 3 With DOS 3 (and especially DOS 3.2) have come many new commands and features. I like to think of these enhancements as falling into one of three categories: new commands (external programs, really), network support, and an enhanced environment (see sidebar "The DOS 3 Environment"). Let's take a look at some of these new commands first.

While using ANSI.SYS to exchange keys will work only with applications that get keyboard input through DOS, the new KEYB.xx programs that come with DOS 3 can be used successfully with all programs. (The .xx signifies additional letters,

such as IT for Italy, SP for Spain, etc.) There is one trade-off, however: only single keys can be exchanged. That is, you can't create multicharacter macros that are typed for you by pressing a single key. Of course, the real purpose of KEYB.xx is to allow IBM PCs to be used in foreign countries, though a clever user could create custom substitutions with DEBUG.

If the KEYB.xx programs are to work on a color/graphics adapter (CGA), all of the foreign-language characters must be available—this is where GRAFTABL comes in. Normally, only the regular ASCII letters, numbers, and punctuation are included on a CGA display adapter. But at the expense of a small amount of system memory, GRAFTABL will make the 128 foreign-language characters and symbols available for display, as well.

In the too-little-too-late category is the DOS 3 ATTRIB program, which allows users to alter the Read-Only and Archive attributes for a file. A file marked Read-Only is protected against being overwritten; a file whose Archive bit is set will be included the next time a Backup (or X-COPY; see the sidebar "XCOPY—The DOS 3.2 Treasure") operation is performed.

Since the beginning of DOS, attributes have been a part of each file's directory entry, though, unfortunately, IBM has never provided a means for users to access them. But while ATTRIB will allow changing these two attributes, it still does not allow modifying those for Hidden, System, Volume Label, or Subdirectory. You probably wouldn't want to mess around with those last two, but being able to hide files could certainly be useful. Consequently, I don't envision a lot of people using ATTRIB, since better programs are already available to do this. (*The Norton Utilities* contains one, as well as Charles Petzold's excellent ATTR program published in the June 10, 1986, issue of *PC Magazine*, Volume 5 Number 11.)

The new LABEL program is another example of IBM's trying to catch up with the rest of the world. Under previous versions of DOS, the only way to assign a label (name) to a disk was while it was being formatted. The DOS 3 LABEL command rectifies this, but it capitalizes everything you type, whereas Norton's version lets

THE DOS 3 ENVIRONMENT

The *environment* first appeared with DOS, Version 2, but its scope and importance have greatly expanded with the release of DOS 3. Originally intended simply as a place in memory to hold system information (such as the current PATH or PROMPT), the environment can also be used as a general-purpose memory pool that all programs can access. Both DOS and non-DOS variables can be stored in the environment area by using the SET command, and the contents of these variables can be retrieved from it by using .BAT files and programming languages.

The most common use of the environment is to store the search path that DOS uses to find a program you have asked it to run. With PATH, you are telling DOS ahead of time, "If you don't find the program I asked for in the current directory (or drive), here's a list of places I want you to look." DOS then checks through the path you have specified before giving up and displaying "Bad command or file name."

Most PC users are quite comfortable with setting a path or prompt without even knowing about the environment and its SET command. But although both PATH and PROMPT may be entered with or without SET, if you want to use user-defined variables, they must be SET in the environment.

INVOKING BATCH FILES Once a variable has been stored within the environment, it may then be accessed from within batch files by surrounding the variable name with a pair of percent signs (%). As an example, in Part 1 we saw how one batch file could invoke another by preceding the called .BAT with COMMAND/C. There is another, albeit more complicated, way to do this without requiring that a second copy of COMMAND.COM be run.

Imagine that you have two batch files (1.BAT and 2.BAT) and that 2.BAT must be able to operate either alone or when called from within 1.BAT. If we

SET a variable into the environment with 1.BAT, then 2.BAT will be able to test that variable, and either return to 1.BAT when it finishes or merely end.

Here are the contents of 1.BAT:

```
CLS
ECHO About to call 2.BAT
SET COMEHOME=YES
2
```

And here's 2.BAT:

```
CLS
ECHO About to return if we were called
IF %COMEHOME%==YES 1
```

Of course, you could get much fancier with this method. For example, you could place the name of the batch file to return to in the environment, rather than merely set a flag.

Here's a modified 1.BAT:

```
CLS
ECHO About to call 2.BAT
SET COMEHOME=1
2
```

And here's the corresponding 2.BAT:

```
CLS
ECHO About to return if we were called
IF NOT %COMEHOME%==X %COMEHOME%
```

Notice how, in the third line of 1.BAT, its own name (%0) is assigned to the variable %COMEHOME%, so 2.BAT will know where to go when it finishes. Also notice the use of the NOT statement in 2.BAT. Since batch files don't have the luxury of a dedicated "not equal to" operator as in BASIC or Pascal, any arguments that are tested this way must be preceded by NOT. In this case, if the environment variable %COMEHOME% is empty, then 2.BAT won't attempt to return anywhere. But if %COMEHOME% has been assigned to anything at all, then 2.BAT will execute what it was set to.

AVOIDING ENDLESS CYCLES One additional complication with this approach is that the original batch file will begin execution at the beginning, when the second one calls it to return. This is

probably not what you had in mind, so again, the environment can be used to determine what to do. Here's a modified 1.BAT with such a test:

```
CLS
ECHO Test if we're returning from somewhere
IF NOT %COMEHOME%==X GOTO MORESTUFF
ECHO About to call 2.BAT
2
:MORESTUFF
ECHO A called batch file ends use here
```

In this case, the first test the batch file must make is to determine whether it has been run from the called batch file or not. If the variable %COMEHOME% is not empty, then this will be the case, and execution continues at the label :MORE-STUFF. But if %COMEHOME% is indeed null, then it is safe to assume that the batch file has just been run from the DOS prompt, and all of its statements are to be performed.

Besides environment variables that you can create and test yourself, applications programs can also examine the environment and use it as a common ground for communicating information. My contact at IBM suggests that this would have been a great place to store information about the type of display adapter that is installed. Of course, it's too late now, but wouldn't it have been wonderful if the EGA had been designed to indicate its presence at power-up this way? Then any program or batch file could easily determine what type of monitor is being used, thus:

```
IF %MONITOR%==EGA ...
```

Though we've only looked at reading our own environment variables, it is just as easy to examine those that are reserved for use by DOS. For example, you could test whether or not a path has been set by entering the following:

```
IF NOT %PATH%==X ECHO %PATH%
```

If a path is currently in effect, then this command will echo it to the display screen. Otherwise nothing will happen.—**Ethan Winer**

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you use both upper- and lowercase letters.

Two programs that you'll never see in the public domain (or anywhere else) are JOIN and SUBST. These DOS 3 goodies allow manipulating disks and directories to accommodate older programs that can't recognize pathnames. Their predecessor, the DOS 2 ASSIGN command, lets you temporarily redirect any disk activity to a different drive, for example, when a program insists on using drive A: or B: for data. Under DOS 2.x, however, if you entered

    ASSIGN A=C B=C

DOS would route all requests for files on either drive A: or B: to the current directory of drive C:. Remember, many older programs were written at a time when people didn't have a drive C:. Consequently, users were often prohibited from entering C: as a drive to hold a program's data during installation.

Like ASSIGN, SUBST allows you to create an "alias" for a given collection of disk files. Unlike ASSIGN, however, SUBST can substitute any directory, not just the current one, for a given drive identifier. A good example to consider here is the original *WordStar* program, which doesn't allow the use of pathnames.

Besides organizing different applications into separate directories, many people like to subdivide each directory into meaningful categories. Thus, while you might keep the *WordStar* programs in a directory called \WS, related groups of documents might be kept in subdirectories beneath the \WS directory. Personal correspondence would be in \WS\PERSONAL, memos in \WS\MEMOS, etc. But once you have started *WordStar* in the \WS directory, it is impossible to get at those files, because a pathname is required to retrieve them.

By using SUBST, each of the directories under \WS can be given a drive identifier such as D: or E:, either from the command line or as part of your AUTOEXEC.BAT file. The example below shows how to do this.

    SUBST D: C:\WS\PERSONAL
    SUBST E: C:\WS\MEMOS

Now, to call up your latest appeal for funds, you would ask for D:MON.LTR, and DOS with look for it in the \WS\PERSONAL directory instead. As you can see, SUBST may be used more than once to reassign several different directory names. Incidentally, SUBST is limited to drive letters only as high as E unless you override it with a LASTDRIVE command in your CONFIG.SYS file. (See the sidebar "The DOS 3 CONFIG.SYS.")

To delete a drive substitution from memory, you enter SUBST with the /D option. The example below abandons the PERSONAL directory while leaving MEMOS intact.

    SUBST D: /D

To get a report on all of the current substitutions, enter SUBST with no parameters, and the various reassignments will be displayed.

A useful application of SUBST is to minimize the number of characters in a PATH statement. If your list of pathnames is very long and detailed, substituted drive letters will let you pack that many more into the path command, as shown below. This example replaces what could have been a very long list of deeply nested directories to be searched.

    PATH D:\;E:\;F:\;G:\;H:\;I:\

JOIN does exactly the opposite and lets you attach a disk drive letter to a subdirectory name. Note that the subdirectory you will be using must be empty, though if it doesn't exist, JOIN will create it for you. Here's how you can refer to drive B: as C:\STUFF instead:

    JOIN B: C:\STUFF

Like SUBST, joined drives are removed with /D, and reported by entering JOIN with no arguments.

SELECT The last command I'll consider here is brand-new with DOS 3.2 and can greatly simplify installation for new users. Along with support for foreign-country keyboard and display capability, the DOS SELECT command lets you alter the date, time, and currency formats. In the past, you could simply make a backup copy of a new DOS disk and be done with it. Even if

a PC is equipped with a hard disk, the SYS command would take care of replacing an older DOS version with a newer one. But since DOS 3.2 has many more options than before, setting up for the first time can be an especially confusing process for first-time users.

The SELECT command will format a disk (floppy or fixed), create CONFIG.SYS and AUTOEXEC.BAT files containing specified country and keyboard codes, and copy all of the DOS programs in one shot. True power users will probably want to skip this one, because they could do the same thing directly. But for people who have never even turned on a PC (and may be reading the manual in a foreign language—English), SELECT will get a system up and running with the minimum amount of user intervention.

MORE BATCH FILE TRICKS Not every new DOS feature is an improvement. Many people have lamented the way DOS 3 handles the ECHO statement in batch files. Under DOS 2, a blank line could be sent to the screen by merely following ECHO with a blank space. That doesn't work anymore. Instead, you can use the null character—CHR$(255)—which you enter on the numeric keypad while holding down the Alt key. Don't forget to leave a space between ECHO and that character, or DOS won't recognize it.

    ECHO <Alt>-255

Better still, instead of using ECHO (which requires an initial ECHO OFF to suppress the commands from being displayed), use REM followed by embedded backspaces. This requires an editor or word processor that lets you enter control codes, since a backspace will be acted on if you try it with COPY CON.

    REM <Ctrl>-H<Ctrl>-H<Ctrl>-H<Ctrl>-H

Be sure also to add three blank spaces after the four ^Hs before you hit Enter, so as to overwrite the actual word REM. Speaking of REMs, another old trick that unfortunately doesn't work with DOS 3 is to use a single period rather than the word REM. This is a pity, since a period is much less obtrusive.

And while we're embedding control

■ PC LAB NOTES

```
CD > \BATCH\MYDIR
CD \LOTUS
123
COPY \BATCH\RETURN+\BATCH\MYDIR \BATCH\RETURN.BAT
RETURN
```

Figure 3: A batch file that uses redirection to store the current directory for later return.

codes, The Norton Utilities comes with a cute program that will beep your speaker, with the idea that you include it in a batch file to indicate when something has finished. But it's just as easy to place the bell character—Chr$(7)—in the file directly. And you don't need any tricks to do this either—just press Ctrl-G.

By the way, ECHO can be used just as effectively from the command line, for example, to send control codes to a printer:

```
ECHO <Alt>-155E > PRN
```

(Recall that the notation means hold down the Alt key while typing 155 on the numeric keypad. Then release the Alt key and hit the letter E.)

When really long batch files are used, the time it can take to process all the lines between a GOTO and the :END label can

be annoying. Instead, call the batch file through COMMAND /C, and you can bail out at any time with EXIT, thus:

```
IF NOT EXIST filename EXIT
```

Another batch trick that many aren't aware of involves protecting important files. By using the EXIST batch command, you can see if a particular file exists on a target disk before overwriting it. This is particularly effective when combined with NOT, as you can see.

```
IF NOT EXIST B:IMPT.COM COPY IMPT.COM B:
```

A copy will be made only if IMPT.COM does not already exist on drive B:.

Saving the current directory is yet another trick that can be performed using batch file techniques alone. Though John Friend's excellent PUSHDIR and POP-DIR programs (Programming/Utilities, Volume 5, Number 10) can save and restore many levels of directories, such a heavy approach isn't always needed. Instead, you can use redirection to store the current directory in a file, and then retrieve it later when you're ready to return. The only extra step needed is to first create a small file (call it RETURN) that contains the letters CD followed by a single blank space (see Figure 3).

This assumes that you have a path to the directory where you keep your batch files. Of course, you could also substitute the name of any directory that has a path to it.

I hope that by presenting some of these infrequently used capabilities of DOS, your curiosity will be piqued enough to investigate further. These are powerful and truly useful features that can both simplify your computing chores and impart the sense of accomplishment that comes from using DOS to its full capacity. 🖭

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■ PROGRAMMING/UTILITIES ■ JEFF PROSISE

INSTANT ASCII AT YOUR SERVICE

Here's the easy way to put a pop-up ASCII table of the entire IBM character set at your fingertips even when you've got an applications program running.

If dropping what you're doing to hunt up an ASCII chart is a frequent annoyance, yet you don't want to blow nearly 40K of RAM on a certain well-known, sometimes-nettlesome utility, I've got a solution for you. ASC.COM is a compact, memory-resident utility that gives you an instant window into the whole onscreen (IBM) ASCII character set, complete with each character's decimal and hexadecimal equivalents.

You can pop up the window over a running applications program at any time, rapidly page through the ASCII table to find the code(s) you need, and pop back into your program without loss of data. Programmers especially will appreciate having this capability at their fingertips, and the source code listing (shown in Figure 1) provides several working illustrations of the methods and principles that underlie the programming of desktop software.

JUST USE IT FOR IT As explained in the sidebar "Downloading ASC," the easiest way to obtain ASC.COM is to download it from the PC Magazine Interactive Reader Service. ASC.ASM, the assembler listing shown in Figure 1, and ASC.BAS, a BASIC program that will automatically create ASC.COM (see Figure 2), are also available without charge from PC-IRS. If you have no modem, of course, you'll have to key in the program yourself.

USING THE PROGRAM You load ASC once, at the beginning of a session, and it installs itself into its own private

block of memory. You might want to include it in your AUTOEXEC.BAT startup file to make installation automatic. It consumes slightly more than 2.5K of RAM. With the program residing invisibly along-

side the rest of the system, pressing Alt-A pops up the ASCII window. Pressing Esc closes it and returns you to the parent program. The window can be called up from within any 80-column text mode, but not

Figure 1: ASC.ASM, the source listing for ASC.COM.

```
;ASC for the IBM Personal Computer - 1986 by Jeff Prosise

kb_data          equ 60h          ;keyboard data port
kb_ctrl          equ 61h          ;keyboard control port
eoi              equ 20h          ;8259 end-of-interrupt value
int_ctrl_port    equ 20h          ;8259 PIC port
a_key            equ 30           ;scan code for 'A' key
alt_key          equ 8            ;shift code for Alt key


code             segment para public 'code'
                 assume cs:code
                 org 100h
begin:           jmp initialize   ;jump to initialization code

notice           db 'Copyright 1986 Ziff-Davis Publishing Co.'
notice2          db 'Programmed by Jeff Prosise'
ibm_signature    db 'IBM'                 ;EGA BIOS signature
adapter          db 2                     ;0 = CGA, 1 = MDA, 2 = EGA
video_segment    dw 0B800h                ;video segment address
video_page       db 0                     ;current video page
border_attr      db 0Fh                   ;window border attribute
text_attr        db 1Fh                   ;window text attribute
header_attr      db 1Fh                   ;window header attribute
window_row       db 1                     ;row of left corner of window
window_column    db 1                     ;column of left corner of window
start_value      db 0                     ;first value in ASCII table
status_setup     db 0                     ;setup of interrupt routine
cursor_mode      dw ?                     ;cursor scan line definition
old_int_9h       label dword
old_keyboard_int dw 2 dup (?)             ;old interrupt vector
screen_buffer    dw offset initialize     ;pointer to screen buffer area

enable_values    db 21h,20h,20h,25h,      ;value to enable CGA display
                 db 2Ah,2Eh,18h
header_text      db ' Dec Hex Char  Dec Hex Char '  ;window header text

;Front-end routine for the keyboard interrupt handler.  Execution is vectored
;here whenever an interrupt 9 is generated by the PC keyboard.

ascview          proc near
                 cmp int_status,0         ;is ASCII table already displayed?
                 jne abort_exit           ;yes, then exit immediately
                 sti                      ;enable interrupts
```
(continues)

■ PROGRAMMING/UTILITIES

in the other video modes that the PC supports. Pressing Alt-A while in one of the unsupported modes won't hurt anything but will simply elicit no response from the computer. Fortunately, all but a few of the programs in which you might want to use the ASCII chart (*Microsoft Word* running in graphics mode is a notable exception) operate in the text environment and should pose no problem to operation.

The open ASC window displays 32 consecutive decimal and hexadecimal ASCII values and the character that each rep-

■ ASC divides the complete ASCII chart into "pages" of 32 characters and gives you several means to control which range is visible at any time.

resents. Because there are 256 ASCII character codes (including the null character, 0), they cannot all be displayed simultaneously within a single, small, unobtrusive window. ASC divides the complete ASCII chart into "pages" of 32 characters and their equivalents and gives you several means to control which range is visible at any time.

The PgUp and PgDn keys move the contents of the window backward and forward, respectively, one page at a time. If the ASCII characters 32–63 are currently shown, pressing PgUp will replace them with the characters 0–31, and PgDn will display the characters in the range 64–95. The Home and End keys let you move quickly to the beginning or end of the table. Additionally, you can scroll the window one line at a time with the Up Arrow and Down Arrow keys. Together, these functions allow you to reach any point in the table rapidly and with a minimum of effort.

When you press Esc to close the ASCII

```
              push    sx              ;save registers
              pop     bh
              push    cx
              push    dx
              push    si
              push    di
              push    ds
              push    es

              in      al,kb_data      ;get scan code from keyboard
              cmp     al,key          ;was the 'A' key pressed?
              jne     exit            ;no, then exit to normal routine
              mov     ah,2            ;get state of shift keys
              int     16h
              test    al,alt_key      ;is the Alt key depressed?
              jne     scl             ;yes, then continue

;Exit is achieved thru here when execution is to be transferred to the normal
;BIOS keyboard interrupt handling routine.
;
exit:         pop     es              ;restore registers
              pop     ds
              pop     di
              pop     si
              pop     dx
              pop     cx
              pop     bx
short_exit:   jmp     old_int_9b      ;goto BIOS keyboard routine
;
;The key combination Alt-A was just pressed.  Reset the keyboard and issue an
;EOI to the 8259 PIC to enable hardware interrupts.
;
scl:          call    kb_reset        ;reset keyboard, end 8259 int
              push    cs              ;set DS and ES to the code segment
              pop     ds
              push    cs
              pop     es
              assume  ds:code
;
;Check the current video mode to see if it's one of the 80-column text modes
;(2, 3, or 7).  If it is, then continue.  If it's not, gracefully abort this
;routine by exiting thru an IRET.
;
              mov     ah,15           ;get video page and display mode
              int     10h
              cmp     al,2            ;video mode 2?
              je      sc2             ;yes, then continue
              cmp     al,3            ;mode 3?
              je      sc2             ;yes, then continue
              cmp     al,7            ;mode 7 (monochrome)?
              je      sc2             ;yes, then continue
done:         pop     es              ;restore register values for exit
              pop     ds
              pop     di
              pop     si
              pop     dx
              pop     cx
              pop     bx
              pop     sx
              iret                    ;return to interrupted program
;
;Save the current video page number and the cursor scan line parameters,
;set the interrupt routine status flag, and blank the cursor.
;
sc2:          mov     video_page,bh   ;save page number
              mov     int_status,1    ;set interrupt routine status flag
              mov     ah,3            ;get the cursor shape
              int     10h
              mov     cursor_mode,cx  ;save it
              mov     ah,1            ;hide the cursor for now
              mov     cx,20h
              int     10h
;
;Save the contents of the portion of the screen that will underlie the window.
;
              cmp     adapter,8       ;is this a CGA?
              jne     sc3             ;no, then skip disable
              call    disable_cga     ;disable CGA video
sc3:          mov     di,screen_buffr ;point DI to storage buffer
              call    save_screen     ;save screen contents
;
;Pop the window border onto the display by writing directly to video. Finish
;things up by filling the blank window with the text of the ASCII table.
;
              call    open_window     ;pop up the window border
                                                      (Figure 1 continues)
```

```
            cmp   adapter,#        ;is this a CGA?
            jne   asc4
            call  enable_cga
asc4:       call  fill_window      ;write the window text
;
;The window is now displayed on the screen.  Wait for a keypress.
;
esc5:       mov   ah,0             ;get a keypress
            int   16h
            cmp   al,0             ;is it an extended code?
            jz    asc10            ;yes, then jump
            cmp   al,27            ;ESC key pressed?
            jne   esc5             ;no, then get another keypress
;
;The ESC key has been pressed.  Restore the contents of the screen,
;restore the cursor, reset the status flag, and exit to the application.
;
            cmp   adapter,#        ;blank video if CGA installed
            jne   asc6
            call  disable_cga
asc6:       mov   si,screen_buffer ;point SI to holding buffer
            call  restore_screen   ;restore video memory contents
            cmp   adapter,#        ;enable video if necessary
            jne   asc7
            call  enable_cga
asc7:       mov   ah,1             ;unblank the cursor
            mov   cx,cursor_mode   ;define cursor scan line
            int   10h
            mov   int_status,#     ;reset status flag
            jmp   done             ;exit
;
;A key has been pressed that returned an extended code.
;
asc10:      cmp   ah,72            ;Up-Arrow pressed?
            jne   asc11
            call  scroll_down      ;no, then jump to next test
            jmp   esc5             ;yes, then scroll down
asc11:      cmp   ah,80            ;return for another keypress
            jne   asc12            ;Down-Arrow pressed?
            call  scroll_up
            jmp   esc5             ;scroll window up
asc12:      cmp   ah,73            ;PgUp pressed?
            jne   asc13
            call  last_window_page ;flip window page back
            jmp   esc5
asc13:      cmp   ah,81            ;PgDn pressed?
            jne   asc14
            call  next_window_page ;flip window page forward
            jmp   esc5
asc14:      cmp   ah,79            ;End pressed?
            jne   asc15
            call  end_window_page  ;flip to last window page
            jmp   esc5
asc15:      cmp   ah,71            ;Home pressed?
            jne   esc16            ;no, then start again
            call  first_window_page ;goto first window page
esc16:      jmp   esc5             ;look for another keypress
;
aseview     endp
;
;---------------------------------------------------------------------
;SAVE_SCREEN saves the contents of the screen beneath the window.
;Entry:  ES:DI - buffer address
;---------------------------------------------------------------------
;
save_screen proc  near
            mov   dh,window_row    ;row and column of window corner
            mov   dl,window_column
            mov   bl,video_page    ;get video page in BX
            xor   bh,bh
            push  di               ;save buffer address
            call  video_offset     ;get starting address of window
            mov   si,di            ;transfer address to SI
            pop   di               ;retrieve buffer address
            push  ds               ;save DS
            mov   ds,video_segment ;set DS to video segment
            assume ds:nothing
            mov   cx,16            ;16 lines to save
save1:      cld                    ;clear DF
            push  cx               ;save line counter
            mov   cx,16            ;30 words per line
            rep   movsw            ;transfer one line to buffer
            add   si,160           ;adjust SI for next line
            pop   cx               ;restore line count
            loop  save1            ;loop until done
            pop   ds
            assume ds:code         ;restore DS
save_screen ret
            endp                                      (Figure 1 continued)
```

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window, everything is restored to the state it was in when you originally pressed Alt-A. Data is intact, the portion of the screen below the window is restored, and to all outward appearances the original program was never interrupted. When you call up the ASCII table again, the page displayed will be the same one you last accessed. I frequently find myself referring to one area of the table repeatedly (most often the box-drawing characters in its upper regions), and setting the window page to the one I want makes it easy to pop right back to the

▪ ASC will work with most programs, with the possible exception of some other resident utilities and nonresident ones that steal the keyboard interrupt.

same place without having to use PgDn after opening the window.

COMPATIBILITY ASC will work with most programs, with the possible exception of some other resident utilities like itself and nonresident ones that steal the keyboard interrupt for their own purposes. [*ASC.COM is compatible with the interrupt-stealing XyWrite III if you put that application's XYKBD.COM in your AUTOEXEC.BAT file.—Ed.*] Everyone knows by now that memory-resident programs have inherent problems in working with each other, so only experimentation will determine whether ASC will work with your favorites. Remember that the order in which such utilities are loaded often affects how well they coreside in memory. Since ASC.COM effectively steals Alt-A and doesn't let the BIOS (or the program that was interrupted) know that that key combination was pressed, it obviously conflicts with programs that assign a function to Alt-A. That combination in *1-2-3*,

```
;RESTORE_SCREEN restores the contents of the screen beneath the window.
;Entry: DS:SI - buffer address
;
restore_screen  proc near
                mov ah,window_row             ;row & above where window starts
                mov dl,window_column
                mov bl,video_page             ;get video page in BX
                xor bh,bh
                call video_offset             ;get window starting address
                mov es,video_segment          ;set ES to video segment
                mov cx,19                      ;19 lines to restore
                cld                            ;clear DF
restorel:       push cx                       ;save line counter
                mov cx,38                      ;38 words per line
                rep movsw                      ;restore one line
                add di,100                     ;set DI for next line
                pop cx                         ;retrieve count
                loop restorel                  ;loop until done
                ret
restore_screen  endp
;
;VIDEO_OFFSET calculates the offset address in video memory that corresponds
;to the given row, column, and video page.
;Entry: DS,DL - row, column          Exit: DI - offset
;       BX - video page
;
video_offset    proc near
                mov al,160                    ;row * 160
                mul dh
                shl dl,1                       ;column * 2
                and dh,dh                      ;zero dh
                add ax,dx                      ;add the two
                mov di,ax                      ;save result in DI
                mov ax,1000h                   ;length of one video page
                mul bx                         ;page * 1000h
                add di,ax                       ;complete the offset address
                ret
video_offset    endp
;
;DISABLE_CGA and ENABLE_CGA routines disable and enable CGA video by writing
;to the Mode Select Register at port address 30Bh.
;
disable_cga     proc near
                mov dx,3DAh                    ;load Status Register address
dischkl:        in al,dx                       ;get video status
                test al,8                      ;vertical retrace active?
                je dischkl                     ;no, then wait until it is
                sub dx,3                       ;load MSR address
                mov al,25h                     ;value to disable video
                out dx,al                      ;send it to the adapter
                ret
disable_cga     endp
;
enable_cga      proc near
                mov ah,15                      ;get current video mode
                int 10h
                lea bx,enable_values           ;offset of enable value table
                xlat                           ;get the value to enable video
                mov dx,30Bh                    ;load address of MSR
                cli
                out dx,al                       ;OUT the enable value
                ret
enable_cga      endp
;
;KB_RESET resets the keyboard and issues an EOI to the 8259 PIC.
;
kb_reset        proc near
                in al,kb_ctrl                  ;get current control port value
                mov ah,al                      ;serve it in AH
                or al,80h                      ;set bit 7
                out kb_ctrl,al                 ;send reset value
                mov al,ah                      ;get original value
                out kb_ctrl,al                 ;send it out to enable keyboard
                cli                            ;suspend interrupts
                mov al,eoi                     ;get EOI value
                out int_ctrl_port,al           ;send EOI to 8259
                sti                            ;enable interrupts
                ret
kb_reset        endp
;
;BIN2ASC outputs a byte value to the screen in decimal or hexadecimal form.
;Entry: DS,DL - row, column
```

(Figure 1 continues)

```
;           AL   - number to output
;           BL   - divisor (10 for decimal output, 16 for hex)
;-----------------------------------------------------------------------
binasc     proc near
           push ax              ;save value to output
           xor cx,cx            ;zero digit counter
           xor ah,ah            ;byte to word in AX
           div bl               ;divide AX by 10 or 16
           push ax              ;save AH (remainder)
           inc cx               ;increment counter
binl:      xor ah,ah            ;byte to word (quotient)
           or al,al             ;zero quotient?
           jne binl             ;no, then go back for more
binz:      pop ax               ;get digit to print next
           mov al,ah            ;put it in AL
           and al,0fh           ;convert binary to ASCII
           cmp al,'9'           ;alphanumeric the digit?
           jna bin3             ;no, then jump ahead
           add al,7             ;yes, then more conversion needed
bin3:      mov ah,text_attr     ;set text attribute for write
           call output_char     ;print the digit
           inc di               ;advance cursor
           loop binz            ;loop until done
           pop ax               ;restore value of AX
           ret
binasc     endp
;-----------------------------------------------------------------------
;OUTPUT_CHAR writes the designated character directly to video memory.
;Entry:  DH,DL - row, column
;        AH    - attribute, character
;-----------------------------------------------------------------------
output_char proc near
           push dx              ;save DX and AX
           push ax
           mov bl,video_page    ;get page in BX
           xor bh,bh
           call output_offset   ;calculate address to write to
           cmp adapter,0        ;is this a CGA?
           jne output1          ;no, then skip wait loop
           mov dx,3DAh          ;get CGA Status Register address
           test al,1
           jne output1          ;wait until horiz. retrace
output1:   cli                  ;suspend interrupts during write
output2:   in al,dx             ;wait for next horizontal retrace
           test al,1
           je output2
output3:   mov ax,es:[di]       ;get character and attribute
           stosw                ;write them to video memory
           sti                  ;enable interrupts
           pop dx               ;restore DX
           ret
output_char endp
;-----------------------------------------------------------------------
;FILL_WINDOW writes the text of the ASCII table to the window.
;-----------------------------------------------------------------------
fill_window proc near
           mov dh,window_row    ;set DH for first text row
           add dh,2
           mov al,start_value   ;get first table value in AL
           mov cx,16            ;16 lines to fill
filll:     push cx              ;save line counter
           mov dl,window_column ;specify starting column
           add dl,2
           call write_line      ;write first half of line
           add al,5             ;advance cursor for next half
           adjust AL for next half
           call write_line      ;write second half
           sub al,15            ;set AL for start of next line
           inc dh               ;set cursor for next row
           pop cx               ;retrieve line counter
           loop filll           ;loop until table full
fill_window endp
;-----------------------------------------------------------------------
;WRITE_LINE outputs one ASCII character and its decimal and hex equivalents.
;Entry:  AL   - ASCII code for character to output
;        DH,DL - row, column to start writing at
;-----------------------------------------------------------------------
write_line proc near
           mov es,video_segment ;set ES to video for writing
           cmp al,100           ;advance cursor if AL < 100
```

(Figure 1 continued)

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for instance, can initiate execution of a user-defined macro. With ASC loaded, you'll get the ASCII window rather than the macro. All of the other Alt-key combinations should work as they normally do, however, so you only forfeit Alt-A.

HOW IT WORKS ASC is divided into two distinct sections. One is the code that becomes resident in memory and the other is the initialization portion. When ASC is first run from the command prompt, it begins by executing the initialization se-

> ■ INT 27h is issued to
> leave all of the code
> resident except for the
> initialization portion.

quence that sets the stage for the resident code to operate at a later time. A handful of tasks must be completed. First, because several of the video routines used to create, remove, and manipulate ASCII window are hardware dependent, it must be determined exactly what type of video adapter is being used. Second, since ASC is initially set up for color, if the program is being used on a monochrome system, the values for the video attributes (the colors used in the window) and the video buffer segment address have to be modified. Next, the cursor is reset to its default power-on form (scan lines 6 and 7 for a color system, 12 and 13 for monochrome). This eliminates problems with some of the older Compaq PCs, which seem to initially reverse the order of the starting and ending scan lines for the cursor in the BIOS data area. The vector pointing the way to the BIOS keyboard interrupt handling routine (interrupt 9) is saved and then reset to the address of the ASCII window routine. Finally, INT 27h is issued to leave all of the code resident except for the initialization portion, which is no longer needed once the program is installed in memory.

If you examine the source listing, you'll notice that when the DX register is prepared for the call to INT 27h by loading the

```
                 jne     write1
                 inc     dl
                 cmp     al,10           ;advance egein if AL < 10
                 jne     write1
                 inc     dl
write1:          mov     bl,18           ;set BL for decimal output
                 call    bin2esc         ;output decimal text
                 edd     dl,2            ;move cursor to next field
                 cmp     el,189          ;advance cursor if AL < 10h
                 jne     write2
                 inc     dl
write2:          mov     bl,16           ;set BL for hex output
                 call    bin2esc         ;output hexedecimel text
                 edd     dl,2            ;goto next field
                 mov     eh,text_ettr    ;set text ettribute
                 cell    output_cher     ;print the cherecter
                 ret
write_line       endp
;
;-----------------------------------------------------------------------
;OPEN_WINDOW drews the window border onto the screen.  Cherecter/ettribute
;peirs ere sent directly to video memory for fest disploy speed.
;-----------------------------------------------------------------------
;
open_window      proc    neer
                 mov     dh,window_row           ;get coordinates of window corner
                 mov     dl,window_column
                 mov     es,video_segment        ;point ES to video buffer
                 mov     dl,2                    ;clear DF for string operations
                 cld                             ;clear DF for video operations
                 mov     hl,video_pege           ;get video pege in BX
                 mov     bh,h0
                 cell    video_offset            ;celculete sterting eddress
;
;Write the top line of the window border to video.
;
                 mov     al,218          ;stert with upper left corner
                 mov     eh,border_ettr  ;set ettribute
                 stosw
                 mov     cx,28           ;do the next 28 cherecters
                 mov     el,196
                 rep     stosw
                 mov     el,191          ;do upper right corner
                 stosw
;
;Do the window heeder line.
;
                 mov     al,180          ;set DI for new line
                 mov     al,179          ;left window border cherecter
                 stosw                   ;write it
                 lee     si,heeder_text  ;point SI to text of line
                 mov     cx,28           ;28 cherecters to write
open1:           lodsb                   ;get the text cherecter
                 stosw                   ;write cher/ettr peir to video
                 loop    open1           ;repeet for ell 28
                 mov     eh,border_ettr  ;do rightmost column
                 mov     el,179
                 stosw
;
;Now write the next 16 lines (no text) to the display.
;
                 mov     al,180          ;set DI for new line
                 mov     cx,16           ;16 lines to do
open2:           push    cx              ;seve line counter
                 mov     al,179          ;do leftmost column
                 mov     eh,border_ettr
                 stosw
                 mov     al,32           ;do next 28 columns (blenk)
                 mov     eh,text_ettr
                 mov     cx,28
                 rep     stosw
                 mov     al,179          ;do rightmost column
                 mov     eh,border_ettr
                 stosw
                 edd     di,100          ;edjust DI for next line
                 pop     cx              ;retrieve counter
                 loop    open2           ;loop until finished
;
;Finish things up by writing the lest line.
;
                 mov     al,192          ;lower left corner
                 stosw
                 mov     cx,28           ;set 28 cherecters
                 mov     al,196
                 rep     stosw
                 mov     al,217          ;lower right corner
                 stosw
```

(Figure 1 continues)

```
            ret
        endp
;
;SCROLL_UP scrolls the window contents up one line.
;---------------------------------------------------------------
scroll_up   proc near
            cmp start_value,224     ;can we scroll more?
            ja scrup1               ;no, then do nothing
            mov sh,6                ;use INT 18h to scroll up
            mov al,1                ;one line
            call define_window      ;set CX and DX for scroll
            mov bh,text_attr        ;define attribute
            int 10h                 ;scroll up
            inc start_value         ;adjust starting value
            mov al,start_value      ;calculate new value to write
            add dl,15
            mov dh,window_row       ;determine row to be written to
            add dh,17
            mov dl,window_column    ;set starting column
            add dl,2
            call write_line         ;write the first half of new line
            add al,16               ;adjust AL
            add dl,5                ;move cursor to next half of line
            call write_line         ;write second half
scrup1:     ret
scroll_up   endp
;
;SCROLL_DOWN scrolls the window contents down one line.
;---------------------------------------------------------------
scroll_down proc near
            cmp start_value,0       ;can we scroll more?
            je scrdn1               ;no, then do nothing
            mov sh,7                ;use INT 10h to scroll down
            mov al,1                ;one line
            call define_window      ;set CX and DX
            mov bh,text_attr        ;set attribute
            int 10h                 ;do the scroll
            dec start_value         ;adjust starting value
            mov al,start_value      ;calculate new value to write
            mov dh,window_row       ;determine row for write
            add dh,2
            mov dl,window_column    ;set starting column
            add dl,2
            call write_line         ;write new line at top
            add al,16               ;adjust AL
            add dl,5                ;move cursor to second half
            call write_line         ;write second half of line
scrdn1:     ret
scroll_down endp
;
;LAST_WINDOW_PAGE pages the window back one page.
;---------------------------------------------------------------
last_window_page proc near
            cmp start_value,0       ;can we go back more?
            je last3                ;no, then do nothing
            cmp start_value,31      ;retaining value > 31?
            ja last1                ;yes, then jump
            mov start_value,0       ;no, then zero value
            jmp last2               ;skip next line
last1:      sub start_value,32      ;set START_VALUE
last2:      call clear_window       ;clear interior of window
            call fill_window        ;write the new table
last3:      ret
last_window_page endp
;
;NEXT_WINDOW_PAGE pages the window forward one page.
;---------------------------------------------------------------
next_window_page proc near
            cmp start_value,224     ;can we go forward more?
            jae next3               ;no, then do nothing
            cmp start_value,193     ;starting value <193?
            jbe next1               ;yes, then jump
            mov start_value,224     ;set START_VALUE to maximum
            jmp next2               ;skip next line
next1:      add start_value,32      ;adjust for next page
next2:      call clear_window       ;clear window
            call fill_window        ;write new text page
next3:      ret
next_window_page endp
;
;FIRST_WINDOW_PAGE flips the window contents to the first page.
```

address of the first byte that is not to be left intact, an extra 1,140 bytes are claimed. There's a good reason. A window 19 rows high and 30 columns wide comprises 570 characters. Each character is represented by 2 bytes in memory, one the code for the character itself, the other for its attribute. Space must be reserved somewhere to save the contents of video memory that will be replaced by the window so that the original screen display can be restored when the window is closed. Normally you might just set aside some room adjacent to the area where you store variable values (i.e., just after the first instruction in the .COM file), but doing that has two drawbacks. First, it lengthens the file image stored on disk; worse, it increases the number of DATA statements in a BASIC program built to create that file. By reserving the necessary space just *beyond* the code that becomes resident upon execution of interrupt 27h, instead of by explicitly locating it within the code at assembly time, you can solve both problems at once.

Once resident in memory, ASC sits quietly in the background and watches for a press of Alt-A. Any other keypress is passed on to the normal BIOS interrupt routine to be processed as usual. When the trigger-key combination is pressed, execution jumps immediately to the heart of the program. Here the keyboard is reset (so that further keypresses can be sensed) and the video mode is checked against a list of the PC's 80-column video modes. If the mode is acceptable, execution continues; if it's not, exit is achieved through an IRET as if Alt-A had not been pressed.

Before the window is opened, a couple of vital parameters must be obtained and recorded. The current video page number and the starting and ending scan lines for the cursor must be determined. The active page must be known so that all video calls can be addressed to it, and the shape of the cursor must be determined so that, after it has been blanked, it can be restored later in the same form.

The window is physically popped onto the screen in three phases. First, the contents of video memory beneath where the window will appear are saved to the buffer area that was set aside beyond the last byte of resident code. Next, the border of the window is drawn. And finally, the text is

■ PROGRAMMING/UTILITIES

filled in. There are a couple of interesting points here.

To give the program a "professional" look, you want it literally to pop onto the screen. This requires writing it up there faster than the eye can follow. This requires writing the border on the screen, not through BIOS video calls (which are notoriously slow), but with direct, unchecked writes to video memory. This presents a problem, however: unregulated accesses to video memory on a color/graphics adapter (CGA) cause unsightly snow to

■ To give the program a "professional" look, you want it literally to pop onto the screen. That means writing it up there faster than the eye can follow.

flash momentarily across the screen, and this looks even worse than having a window slowly paint itself into existence. So, if the video adapter is a CGA (the program knows this, thanks to the initialization routine), the trick is to blank the display before accessing video memory and unblank it when the writing is finished. You'll see a slight flicker, but the window seems to appear instantly and the display is free of snow. Video memory on a monochrome display adapter (MDA) and an enhanced graphics adapter (EGA) can be freely manipulated without causing such video interference.

There are a couple of other ways to write directly to CGA video and still avoid interference. You can safely access video memory during either the vertical or the horizontal raster scan retrace cycles. Status bits in the CGA Status Register (port address 3DAh) tell you when a retrace is in progress by going high during its short duration. A vertical retrace lasts long enough to send several bytes or words to video and still not risk out

```
;=====================================================
first_window_page proc near
        cmp start_value,0       ;already at beginning?
        je first1               ;yes, then do nothing
        mov start_value,0       ;zero starting value
        call clear_window       ;clear window
        call fill_window        ;write text to window
first1: ret
first_window_page endp
;=====================================================
;END_WINDOW_PAGE flips the window contents to the final page.
;
end_window_page proc near
        cmp start_value,224     ;already at end?
        je end1                 ;yes, then do nothing
        mov start_value,224     ;set START_VALUE to maximum
        call clear_window       ;clear window
        call fill_window        ;write window text
end1:   ret
end_window_page endp
;=====================================================
;CLEAR_WINDOW clears the interior of the window.
;
clear_window proc near
        mov ah,6                ;use INT 10h to clear window
        mov al,0                ;code for blank function
        call define_window      ;set CX and DX
        mov bh,text_attr        ;set attribute for cleared area
        int 10h                 ;perform the clear
        ret
clear_window endp
;=====================================================
;DEFINE_WINDOW sets the values of CX and DX for call to BIOS scroll functions.
;
define_window proc near
        mov ch,window_row       ;define upper left corner in CX
        add ch,2
        mov cl,window_column
        add cl,2
        mov dx,cx               ;define lower right corner in DX
        add dh,15
        add dl,25
        ret
define_window endp
;=====================================================
;INITIALIZE performs a variety of tasks to set the stage for the resident part
;of the program.
;
initialize  proc near
;
;See if the display adapter is an EGA by looking for the EGA BIOS signature.
;
        mov ax,0C000h           ;set ES to EGA BIOS segment
        mov es,ax
        mov di,1Eh              ;point DI to signature location
        lea si,ibm_signature    ;point SI to 'IBM' test
        mov cx,3                ;three bytes to compare
        cld                     ;clear DF
        repe cmpsb              ;check three bytes
        jz init1                ;jump if EGA signature found
;
;The display adapter is not an EGA.  Determine whether it's a CGA or an MDA.
;
        mov ADAPTER,0           ;zero ADAPTER for CGA
        mov bh,15               ;get video mode
        int 10h
        cmp al,7                ;is it mode 7?
        jne init2               ;no, then it's a CGA - jump
        inc adapter             ;yes, it's an MDA - set ADAPTER
;
;If this is a monochrome system, modify color-dependant values accordingly.
;
init1:  cmp al,7                ;is current video mode 7?
        je init2                ;yes, then branch
        cmp al,15               ;is current video mode 15?
        jne init3               ;no, then skip modification code
init2:  mov VIDEO_SEGMENT,0B000h ;set VIDEO_SEGMENT for monochrome
        sub video_segment,800h
        mov hordar_attr,70h     ;change attributes for monochrome
```

(Figure 1 continues)

```
        mov     text_attr,87h
        mov     header_attr,87h
;
;Reset the cursor to ecion line 6 and 7 (color) or 12 and 13 (monochrome).
;
init3:  mov     cx,8C8Dh                ;monochrome cursor type
        cmp     al,7                    ;video mode 7?
        je      init4                   ;video mode 77
        cmp     al,15                   ;video mode 157
        je      init4                   ;yes, then jump
        mov     cx,8687h                ;scan lines 6 and 7 for color
        mov     ah,1                    ;set cursor type
        int     10h
;
;Now save the old interrupt 9 vector and replace it with one pointing to the
;code that we will leave behind in memory.
;
        mov     ah,35h                  ;get current interrupt 9 vector
        mov     al,9
        int     21h
        mov     old_keyboard_int,bx     ;save vector offset
        mov     old_keyboard_int[2],es  ;save vector segment
        mov     ah,25h                  ;set new vector
        mov     al,9
        lea     dx,secview              ;point it to body of program
        int     21h
;
;Exit thru INT 27h here reserve enough room beyond the actual code to store the
;contents of the area of screen that underlies the pop-up window.
;
        mov     dx,offset initialize+1148 ;reserve space for code and buffer
        int     27h                     ;terminates-but-stay-resident
initialize      endp
;
code            ends
        end     begin
```

(Figure 1 ends)

lasting the cycle. Horizontal retraces occur much more frequently than vertical ones but are very short and are best suited for spitting out one quick character.

BIOS character output routines write during the horizontal retrace. ASC uses a custom character/attribute write routine very similar to the BIOS routines to send the text of the window to video memory. Why use a custom routine? For one thing, of course, custom code written reasonably well will be considerably faster than INT 10h routines.

A second, and perhaps more important reason, is this: ASC avoids the need to save the cursor position before the window is called up because direct output routines don't require you to move the cursor in order to write characters. All that must be done when the window is closed is to unblank the cursor, and it will reappear where it was before Alt-A was pressed. But if the BIOS output routines are used, the cursor must be moved. So what? It might seem simple just to get the cursor's position through INT 10h and save it, but

DOWNLOADING ASC

The programs that appear in our Programming/Utilities column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. Making copies for others (including placement on other electronic bulletin boards), with or without charge, is a violation of the Ziff-Davis copyright.

The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1,200 (or 300) bits per second, 8 data bits, 1 stop bit, no parity. PC-IRS lists with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

ASC.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create ASC.COM when run once in BASIC. ASC.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft) and the following commands:

```
MASM ASC;
LINK ASC;
EXE2BIN ASC ASC.COM
```

ASC AT A GLANCE

Syntax:

[d:][path]ASC

Operation:

ASC is a memory-resident utility that displays the extended ASCII (IBM) character set, with corresponding decimal and hexadecimal codes. It works with MDA, CGA, and EGA displays in text mode.

Once loaded, either at the command line prompt or via an AUTOEXEC .BAT file, ASC is invoked with the Alt-A key combination. Its pop-up window overlays any currently running application, to which return is made by pressing the Esc key. Home/End, Pg-Up/PgDn, and Cursor Up/Down keys are used to move form one part of the ASCII table to another.

Apart from reserving Alt-A for its own use, ASC.COM is compatible with most applications, although conflicts may arise when using other terminate-but-stay-resident utilities or with programs that themselves appropriate the keyboard interrupts.

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```
100 REM -- BASIC PROGRAM TO CREATE ASC.COM
110 OPEN "ASC.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO 147
150   LINESUM = 0
160   FOR J = 1 TO 8
170     READ BYTE
180     CHECKSUM = CHECKSUM + BYTE
190     LINESUM = LINESUM + BYTE
200     IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210     PUT #1
220   NEXT J
230   READ LINECHECK
240   IF LINECHECK <> LINESUM THEN PRINT "Error in Line";280 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 117531 THEN PRINT "Successful Completion!" : END
280 PRINT "CON file is not valid!" : END
300 DATA 233, 29, 4, 117, 121, 111, 114, 791
310 DATA 185, 183, 184, 114, 32, 49, 57, 56, 622
320 DATA 54, 32, 90, 185, 182, 182, 45, 68, 598
330 DATA 97, 118, 185, 115, 32, 98, 121, 98, 762
340 DATA 188, 185, 115, 184, 185, 118, 183, 32, 762
350 DATA 67, 111, 46, 80, 114, 111, 103, 114, 746
360 DATA 97, 189, 189, 101, 180, 32, 98, 121, 767
370 DATA 52, 74, 101, 102, 102, 32, 80, 114, 637
380 DATA 111, 115, 185, 115, 181, 32, 73, 66, 710
390 DATA 77, 2, 8, 184, 0, 15, 31, 30, 339
400 DATA 1, 1, 8, 8, 4, 8, 4, 45, 207
410 DATA 8, 42, 46, 30, 32, 68, 181, 99, 410
420 DATA 32, 32, 181, 120, 32, 67, 184, 97, 625
430 DATA 114, 32, 52, 68, 101, 99, 32, 72, 510
440 DATA 181, 128, 32, 67, 184, 97, 114, 32, 647
450 DATA 46, 128, 62, 83, 1, 8, 117, 51, 468
460 DATA 251, 188, 32, 82, 86, 87, 30, 780
470 DATA 4, 228, 96, 66, 38, 117, 8, 100, 725
480 DATA 2, 205, 22, 160, 8, 117, 13, 7, 542
490 DATA 31, 95, 94, 90, 89, 91, 88, 46, 624
500 DATA 205, 46, 96, 1, 232, 74, 1, 94, 745
510 DATA 31, 14, 7, 188, 15, 205, 16, 68, 520
520 DATA 2, 116, 17, 48, 3, 116, 13, 68, 387
530 DATA 7, 116, 9, 7, 31, 95, 94, 90, 449
540 DATA 89, 91, 88, 207, 136, 62, 76, 1, 750
550 DATA 198, 6, 83, 1, 1, 180, 3, 205, 477
560 DATA 16, 137, 14, 84, 1, 188, 1, 181, 614
570 DATA 32, 205, 16, 128, 62, 73, 1, 8, 517
580 DATA 117, 3, 232, 239, 0, 232, 163, 1, 987
590 DATA 62, 73, 1, 8, 117, 3, 232, 234, 732
600 DATA 8, 233, 4, 1, 180, 8, 205, 22, 724
610 DATA 60, 8, 116, 46, 60, 187, 8, 117, 800
620 DATA 128, 62, 73, 1, 6, 117, 5, 232, 580
630 DATA 235, 242, 187, 8, 117, 9, 232, 232, 1120
640 DATA 194, 8, 139, 54, 90, 1, 232, 129, 859
650 DATA 8, 128, 62, 73, 1, 8, 117, 3, 384
660 DATA 68, 8, 116, 46, 60, 187, 8, 117, 550
670 DATA 128, 62, 73, 1, 6, 117, 3, 232, 518
680 DATA 194, 8, 139, 54, 90, 1, 232, 129, 859
690 DATA 8, 128, 62, 73, 1, 8, 117, 3, 384
700 DATA 232, 192, 8, 188, 1, 139, 14, 84, 642
710 DATA 1, 205, 16, 198, 6, 83, 1, 1, 510
720 DATA 235, 137, 128, 252, 72, 117, 5, 232, 1038
730 DATA 73, 117, 5, 232, 59, 0, 235, 172, 895
740 DATA 128, 252, 81, 117, 5, 232, 83, 1, 889
750 DATA 235, 162, 128, 252, 79, 117, 5, 232, 1230
760 DATA 126, 2, 235, 152, 128, 252, 71, 117, 1173
770 DATA 5, 232, 97, 2, 235, 142, 138, 54, 905
780 DATA 80, 1, 138, 22, 81, 1, 138, 36, 497
790 DATA 86, 137, 118, 82, 1, 232, 8, 0, 663
800 DATA 139, 247, 95, 58, 142, 58, 74, 1, 750
810 DATA 185, 19, 0, 252, 81, 185, 30, 6, 549
820 DATA 31, 195, 138, 54, 80, 1, 138, 22, 635
830 DATA 81, 1, 138, 38, 76, 1, 86, 137, 494
840 DATA 19, 0, 252, 81, 185, 38, 0, 243, 810
850 DATA 165, 231, 199, 180, 189, 49, 234, 114, 1349
860 DATA 176, 168, 246, 218, 280, 226, 16, 246, 1399
870 DATA 5, 194, 195, 246, 185, 16, 16, 247, 1053
880 DATA 227, 1, 248, 145, 186, 219, 3, 256, 1316
900 DATA 74, 1, 138, 22, 81, 1, 236, 139, 386
910 DATA 198, 8, 195, 185, 108, 15, 225, 61, 1110
920 DATA 37, 238, 195, 14, 118, 129, 88, 1352
930 DATA 38, 92, 1, 215, 106, 216, 3, 736, 1116
```

Figure 2: A BASIC program that will automatically create ASC.COM.

there's a catch. Some "ill-behaved" programs, *1-2-3* being a shining example, manipulate the cursor by writing directly to the video controller chip on the adapter. Such programs don't bother to keep the BIOS informed of the cursor's whereabouts. That makes it extremely difficult to find the true location. Since ASC.COM never moves the cursor, then, the problem of finding and saving its position doesn't arise.

With the window present on the display, ASC enters a loop that solicits keystrokes and acts on those that have functions assigned to them. PgUp, PgDn, Home, End, Cursor Up, and Cursor Down all send signals to change the range of currently shown ASCII values appropriately. A press of the Esc key ends the loop, closes the window by writing the saved contents of the screen from the buffer area back out to video memory), and redisplays the cursor. (Again, if a CGA is in use, the display is blanked during video memory accesses.) Once more, ASC silently sits behind the scenes, monitoring the keyboard for a press of Alt-A to signal that its services are again requested.

AN INTERESTING ALGORITHM One routine in the program is worth a closer examination. BIN2ASC, short for binary to ASCII, is the output routine that converts a binary value into decimal or hexadecimal text and prints it. The value of BL on entry to the subroutine specifies the form of the output. If BL=10, output is decimal, and if BL=16, output is hex. The basic algorithm for such conversions is as follows: Divide the binary value by the base (in this case 10 or 16), and the remainder will be the rightmost digit in the number. Push the remainder onto the stack and compare the quotient to zero. If it's zero, you're done; if it's not, you take the quotient as the primary value and loop back to divide again, repeating the process until you finally obtain a zero quotient. You now have the binary value of each individual digit of the original number stored on the stack. By consecutively popping them off, ORing them with the value 48 to convert the binary digit to ASCII (and adding 7 if it is a hex alphanumeric digit), and then printing in left-to-right fashion, you have successfully output the number in text form. It's actual-

(continues)

■ **PROGRAMMING/UTILITIES**

```
 940 DATA 238, 32, 251, 195, 80, 51, 281, 50, 1098
 950 DATA 228, 246, 243, 88, 65, 50, 228, 18, 1150
 960 DATA 192, 117, 246, 88, 138, 196, 12, 48, 1037
 970 DATA 68, 57, 138, 2, 4, 7, 138, 38, 624
 980 DATA 1, 1, 332, 6, 8, 254, 194, 254, 993
 990 DATA 234, 80, 195, 62, 80, 138, 30, 76, 923
1000 DATA 1, 50, 255, 232, 130, 255, 126, 62, 1111
1010 DATA 73, 1, 8, 117, 6, 106, 218, 3, 612
1020 DATA 236, 168, 1, 117, 251, 250, 336, 168, 1437
1030 DATA 1, 116, 251, 80, 171, 251, 90, 195, 1163
1040 DATA 138, 54, 80, 1, 128, 190, 2, 168, 761
1050 DATA 82, 1, 185, 16, 8, 61, 130, 22, 525
1060 DATA 81, 1, 128, 194, 2, 232, 16, 8, 654
1070 DATA 126, 194, 5, 4, 16, 232, 8, 8, 587
1080 DATA 44, 15, 254, 198, 89, 226, 230, 195, 1251
1090 DATA 142, 6, 74, 1, 68, 108, 115, 8, 500
1100 DATA 254, 104, 68, 18, 115, 2, 254, 194, 1033
1110 DATA 179, 18, 232, 119, 255, 238, 194, 2, 1119
1120 DATA 60, 16, 115, 2, 254, 194, 179, 16, 936
1130 DATA 232, 105, 255, 128, 196, 2, 138, 36, 1092
1140 DATA 78, 1, 232, 134, 255, 195, 138, 54, 1087
1150 DATA 80, 1, 134, 22, 81, 1, 142, 6, 471
1160 DATA 74, 1, 252, 138, 30, 76, 1, 58, 622
1170 DATA 255, 232, 4, 255, 196, 218, 130, 30, 1316
1180 DATA 77, 1, 171, 105, 28, 8, 176, 196, 834
1190 DATA 243, 171, 176, 191, 171, 131, 199, 108, 1382
1200 DATA 176, 179, 171, 141, 54, 108, 1, 105, 1007
1210 DATA 28, 8, 138, 30, 79, 1, 172, 171, 627
1220 DATA 226, 252, 138, 30, 7, 1, 176, 179, 1087
1230 DATA 171, 131, 199, 108, 105, 16, 8, 81, 803
1240 DATA 176, 179, 134, 30, 77, 1, 171, 176, 956
1250 DATA 32, 138, 36, 78, 1, 105, 20, 8, 418
1260 DATA 81, 176, 179, 134, 30, 76, 1, 172, 849
1270 DATA 28, 8, 138, 36, 78, 1, 105, 28, 422
1280 DATA 8, 81, 176, 179, 134, 30, 76, 1, 685
1290 DATA 186, 1, 224, 116, 47, 108, 8, 176, 752
1300 DATA 232, 214, 6, 138, 62, 70, 2, 107, 831
1310 DATA 16, 254, 6, 82, 1, 168, 62, 1, 590
1320 DATA 4, 15, 136, 54, 80, 1, 168, 62, 520
1330 DATA 232, 45, 255, 6, 16, 128, 194, 5, 881
1340 DATA 232, 37, 255, 195, 128, 62, 82, 1, 992
1350 DATA 159, 8, 138, 62, 70, 1, 205, 16, 659
1360 DATA 254, 14, 82, 1, 168, 82, 1, 138, 732
1370 DATA 30, 76, 1, 148, 205, 16, 254, 22, 752
1380 DATA 82, 1, 168, 82, 1, 138, 30, 76, 580
1390 DATA 1, 24, 205, 16, 254, 22, 232, 214, 768
1400 DATA 6, 16, 128, 194, 5, 232, 208, 254, 843
1410 DATA 195, 128, 62, 82, 1, 8, 116, 26, 618
1420 DATA 128, 62, 82, 1, 8, 119, 6, 198, 610
1430 DATA 66, 82, 1, 0, 235, 6, 144, 138, 660
1440 DATA 46, 82, 1, 32, 233, 76, 0, 232, 701
1450 DATA 166, 254, 195, 189, 62, 82, 1, 224, 1112
1460 DATA 116, 36, 120, 62, 82, 1, 193, 114, 722
1470 DATA 0, 190, 6, 82, 1, 224, 255, 6, 760
1480 DATA 144, 128, 6, 82, 1, 32, 232, 62, 603
1490 DATA 0, 232, 132, 254, 195, 128, 62, 82, 1085
1500 DATA 1, 8, 116, 11, 190, 6, 82, 1, 415
1510 DATA 0, 332, 23, 0, 232, 113, 254, 195, 1049
1520 DATA 128, 62, 82, 1, 224, 116, 11, 190, 822
1530 DATA 6, 82, 1, 224, 232, 4, 82, 781
1560 DATA 94, 254, 195, 186, 6, 176, 8, 232, 1137
1570 DATA 7, 0, 138, 62, 70, 1, 205, 16, 547
1580 DATA 195, 130, 62, 70, 1, 128, 193, 2, 787
1590 DATA 138, 14, 81, 1, 128, 193, 2, 139, 696
1600 DATA 205, 128, 194, 15, 128, 194, 15, 138, 933
1610 DATA 144, 8, 192, 142, 192, 191, 30, 8, 933
1620 DATA 141, 5, 78, 1, 165, 6, 252, 706, 1314
1630 DATA 243, 166, 116, 17, 190, 6, 73, 1, 820
1640 DATA 0, 190, 15, 232, 66, 60, 7, 116, 523
1650 DATA 4, 254, 6, 73, 1, 68, 7, 116, 523
1660 DATA 4, 60, 15, 232, 21, 129, 46, 74, 634
1670 DATA 1, 0, 0, 190, 6, 77, 1, 112, 403
1680 DATA 190, 74, 0, 7, 190, 6, 77, 1, 573
1690 DATA 7, 185, 13, 12, 68, 7, 68, 146, 507
1700 DATA 7, 60, 15, 136, 7, 185, 7, 6, 399
1710 DATA 180, 1, 205, 16, 108, 13, 128, 6, 623
1720 DATA 205, 33, 177, 30, 86, 6, 138, 206, 881
1730 DATA 60, 1, 108, 37, 176, 9, 141, 23, 654
1740 DATA 128, 1, 205, 33, 148, 9, 205, 915
1750 DATA 39, 0, 0, 0, 0, 0, 0, 0, 39
```

ly simpler than it sounds, as you can verify by looking at the source listing.

MODIFYING THE PROGRAM One heretofore unmentioned book was built into ASC to allow you to pull off a neat trick. If you should ever need to have more than one ASCII window present on the screen simultaneously, you can load the program more than once, in which case successive presses of Alt-A will pop up additional windows. You can modify the COM file with DEBUG to change the location at which the window appears to prevent multiple windows from covering each other up. Two bytes, located at offsets 150h and 151h (labeled WINDOW_ROW and WINDOW_COLUMN in the source code), determine the placement. Change these to the row (0–24) and the column (0–79) you want to assign to the upper-left-hand corner of the window, and you're all set to transform ASC into a limited multiwindow facility.

You can also change the window colors very easily. Three bytes, labeled BORDER_ATTR, TEXT_ATTR, and HEADER_ATTR in the source and located at offsets 14D to 14Fh, hold the attribute values used to create the window border, text, and header line. Changing those bytes alters the color scheme. You might be interested in these if you have a monochrome monitor connected to the composite video output jack of a CGA. Although a program can tell what kind of video adapter is installed, it can't tell what kind of monitor is attached to that adapter. If you're using a composite monochrome display and have difficulty reading the window, change the attribute bytes to the values 70h, 07h, and 07h, respectively, for maximum contrast and definition.

If you're a programmer, I hope you'll use ASC.COM as a guide in creating your own resident utilities. An interesting challenge would be to customize the program to allow the window to be moved around the screen in real time using four keys of your choice, creating a true multiwindow effect. In any case, here's hoping that ASC.COM becomes a permanent addition to your library.

(Figure 2 ends)

Jeff Prosise is a frequent contributor to the Programming/Utilities column.

■ JARED TAYLOR

SPREADSHEET CLINIC

Indirect addressing in 1-2-3 macros, quick copying without macros, undocumented uses for F3, calculating running totals, using a mouse with SuperCalc4.

VARIABLE ADDRESSES IN MACROS
Both *Symphony* and Release 2.0 of *1-2-3* allow you to write macros that specify addresses indirectly. This lets you change the operation of a macro by changing the contents of one or more cells.

Three examples of this are shown in Figure 1. All are string formulas that result in macro statements that refer to other cells for instructions on how the macro should operate. The first example is a simple {goto}, except that the address to which the cursor is to go is whatever is contained in cell A1.

It is important to realize that when this formula is actually entered into a cell it will *look* different. For example, if cell A1 contained the string D18, the formula would be displayed as {goto}D18. This string of text would operate as a normal macro statement. The advantage of writing the macro statement as a formula rather than as a label is that whatever appears in cell A1 will be reflected in the macro statement and so will affect the way the macro operates. The location to which the statement sends the cursor can thus be affected by anything that affects cell A1.

The second formula uses the same technique to specify a subroutine to which the macro should branch. In this case the macro branches to "FRED," but FRED is not the name of the subroutine itself. Instead, the cell named FRED contains a text string that is the name of the subroutine. Thus, if the cell named FRED contained the word PRINT, the macro statement would hand over operation to a subroutine named PRINT. By changing the contents of

FRED, you can select a different subroutine to which the macro will branch.

The third example uses a string formula to display a macro statement that copies one range to another. Once again, the "from" and "to" ranges are not LOC1 and LOC2, but the addresses contained in the cells that bear these names. As the contents of LOC1 and LOC2 change, so will the operation of the macro.

There are virtually unlimited uses for this approach to indirect addressing. It allows great flexibility in macro control.

Fred Rosen
New City, New York

This is a sophisticated macro-writing technique that uses formulas that act, in macros, just like labels. As Mr. Rosen points out, the display is markedly different from the formula, so be alert when you debug a macro that uses string formulas. The underlying formula may be visible only by

going to that cell and hitting F2 (Edit).

Moreover, when experimenting with this technique, be sure that the range names (such as FRED, LOC1, and LOC2 in these examples) actually exist before you write the formulas. As is the case with any formula, a reference to a nonexistent range name will make the computer beep, and you won't even be able to enter the formula into the spreadsheet.

Note, too, that the contents of the named ranges must make sense. In the first example, for instance, if cell A1 contains something other than a legal cell address, while you will be able to enter the formula into your spreadsheet, you will get an ERR display. Finally, be careful to use the quotation marks and ampersands correctly. Errors will prevent you from entering the formulas.

Notwithstanding such procedural caveats, this is indeed a powerful and versatile tool for macro writers.

QUICK COPIES
When I use a spreadsheet, I often find I need to copy something several times, though not so often as to make it worthwhile to write a macro. The trick I use with *1-2-3* is to name the range to be copied with the name C. Having done this, I can very quickly copy the range to the new location by moving the cursor to that spot and typing

/cc<Enter><Enter>

This is faster and less error-prone than pointing, since I have to find only three keys.

```
(1)    +"{goto}"&+A1&""

(2)    +"{branch "&+FRED&"}"

(3)    +"/c"&+LOC1&"~"&+LOC2&"~"

        Symphony Version:
        +"{MENU}c"&+LOC1&"~"&+LOC2&"~"
```

Figure 1: *Three formulas that create macro statements. Each statement uses indirect addressing to carry out macro operations. The first two formulas will work in both Symphony and 1-2-3, Release 2.0. Separate versions are given for the third.*

■ SPREADSHEET CLINIC

You can demonstrate to yourself the advantages of this method with the following example: Enter a column of data in cells A5..A25. Try to copy this data to columns B, D, F, and H either by pointing or by typing in cell addresses. Then try it by calling the data C, moving the cursor to the new locations, and typing

```
/cc<Enter><Enter>
```

each time.

Richard Aitkins
Renton, Washington

There's no comparison. I'm a convert. And this technique will work for any spreadsheet that lets you name ranges and copy them.

UNDOCUMENTED NAME-KEY USE
According to the manual for *1-2-3*, Releases 2.0 and 2.01, the only use for the NAME key (F3 on a PC) is to produce a list of range names. For example, /md<F3> will produce a list of range names, one of which you can delete by highlighting it and hitting Enter.

The manual fails to mention that NAME can also be used with commands like /File Retrieve and /Print File that display a list of appropriate filenames on the third line of the control panel. When F3 at that point will produce a complete directory of files on the disk, just as the /File List command does. File size, creation date, and time are all displayed. Moving the cursor to the file of your choice and then hitting Enter will complete the command for that file.

Why a description of this convenient feature was left out of the manual is anyone's guess. In any case, Figure 2 shows a typical screen that will appear after the /File Retrieve <F3> sequence.

Paul Padrutt
Marion, Ohio

Yet another surprise from the boys in Cambridge! This trick works with all the /File

Figure 3: *A formula that speeds up year-to-date calculations.*

commands that produce a list of files, so in the middle of a /File Erase, Import, Combine, etc., you can get a full list of files on disk along with their size and creation

> ■ To copy something several times, the trick I use is to name the range to be copied with the name C.

data. Needless to say, if there are no matching files on the disk, hitting F3 will only make your computer beep.

YEAR-TO-DATE TOTALS
When using *1-2-3*, it's often useful to calculate running totals, such as those shown in Figure 3. Actual sales numbers are entered in cells F4 to J5. Year-to-date totals appear in cells F10 to J11.

There's more than one way to do this calculation, but the quickest is to use the formula in cell F10: @sum($F4..F4). You can then copy this to any cell that will come running totals—in this case, to cells F10 to J11. In cell F11, the formula becomes @sum($F4..F5), in F12 it becomes @sum($F4..F6), etc. Since only the col-

umn letter is absolute, you can copy the formula in F10 down as well as across.

Note that you must enter the formula without pointing. This is because *1-2-3* will not let you enter a mixture of absolute and nonabsolute addresses in pointing mode.

Tracy Cassil
Newton, Kansas

Yes, there are other ways to do this, the most obvious being to start the year-to-date formulas with the same numbers as the first month's sales figures. The formula in F10 would be +F4, the one in F11 would be +F5. Then, using the same mixed address principle outlined above, cell G10 would contain the formula @sum($F4..G4), which could be copied down and to the right. Using F4 twice in the same @sum formula cleverly eliminates the first step.

SUPER MOUSE
The Microsoft Mouse comes with a program designed for use with *1-2-3*. It makes the cursor fly across the screen, and filling in data is a breeze. While the mouse doesn't come with a program to use with *SuperCalc*, the good news is that you can modify the *1-2-3* program to work perfectly with *SuperCalc4*. The simple change required is shown in Figure 4.

After you save the change, rename the file to SC4.DEF. Then compile the file with the Microsoft Mouse program called MAKEMENU, so as to produce the file SC4.MNU. With these two files you will have a perfect working mouse interface for *SuperCalc4* and will soon be just as spoiled as I am.

Robert Urbain
Livonia, Michigan

Figure 2: *A typical screen that might appear after the sequence /fr<F3>.*

■ SPREADSHEET CLINIC

```
The Microsoft file 123.DEF contains the interface for 1-2-3. Change line 36
from:

    rbl: MATCH 1,76,,"READY",SLASH,RETURN        ;"READY"

to:

    rbl: MATCH 25,1,,"READY",SLASH,RETURN        ;"READY"
```

Figure 4: *The interface change required to make the Microsoft Mouse work with SuperCalc4 instead of with 1-2-3.*

Mice are definitely an amusing accessory. The one I personally prefer is the Logitech mouse, which also comes with a 1-2-3 interface. You can move, copy, and delete with it as it comes, and you can even program its keys for the spreadsheet commands you like best.

SPEEDING UP MACROS
With Release 2.0 of 1-2-3, you can use {windowsoff} and {paneloff} to turn off screen updating and speed up macro oper-

ation. You don't have that option in Release 1A, but you can get some of the speed benefits by using windows. When your macro is about to start a lengthy routine with a lot of screen updates, make a window only one row deep at the top of the spreadsheet. Switch to the other, larger window, and move the cursor to a point in the spreadsheet where the screen is blank. Switch back to the small window and make that the active one in which the macro does its work. The screen will have to be

updated only in that single line, and many macros will run much more quickly.

Ralph D. Sappe
Poughkeepsie, New York

Instead of moving the lower window to a completely blank part of the spreadsheet, you might move it to a spot that contains a brief message explaining that the program is doing calculations and that it will return to normal soon.

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■ NEIL J. RUBENKING

TURBO POWER USER

Fast string searches in large arrays, handling interactive I/O safely, more on patching past Turbo's initial bottleneck, writing Turbo listings to PRN.

YESNO PATCH

The August 6, 1985, Power User column (Volume 4 Number 16) contained a patch to make Turbo skip the "Include error messages?" question. Mr. Joel Charbonier of Irvine, California noted that the patch does not work for version 3.01A. Figure 1 shows the required patches for the regular, the 8087, and the BCD versions of PC-DOS Turbo, Version 3.01. A number of other patches are available from Borland covering the various versions and operating systems (PC-DOS, MS-DOS, or CP/M 86). If you're really up to date and have already acquired Version 3.02, see the next item.

3.02 TURBO PATCH

Turbo Pascal always asks, "Include error messages?" when it starts. Since the answer is likely to be the same every time, many users like to patch TURBO.COM so that their preferred answer is automatic. However, the patch for previous versions won't work with Turbo 3.02A.

The DEBUG script below is for patching PC-DOS Turbo 3.02A.

```
a 2F53
mov byte ptr [034A],1
nop
nop
nop
w
q
```

Type in the script using the Turbo editor, and don't omit the blank line after the third

NOP or the carriage return after the final q. Save the script as YESNO.PAT. As shown, the script makes the answer an automatic YES. Change the final 1 in the second line to a 0 if you want to make it an automatic NO.

To use the script, first save a copy of TURBO.COM, just in case. Now type

```
DEBUG TURBO.COM < SCRIPT.PAT
```

That's it. To patch TURBOBCD.COM, change 2F53 to 2E75 in the first line and 034A to 037E in the second line. To patch TURBO-87.COM, change 2F53 to 2A19 in the first line and 034A to 0352 in the second line.

Brian Foley
Scotts Valley, California

Figure 1: Patches to eliminate the "Include error messages?" question for Turbo Pascal, Version 3.01A.

Using a DEBUG script file, as Mr. Foley does, may be easier for some users than the straightforward DEBUG patching method shown in the previous item.

LARGE-SCALE SEARCH

Before coming to Turbo, I'd been using compiled Microsoft BASIC, which allowed me to create strings of up to 32,767 characters in length. Turbo's 255-character string-length limit was originally a disappointment.

When I decided to write a text editor in Turbo, I was forced to use arrays of type CHAR. This presented a problem when it came time to write the search-and-replace procedures. Turbo allows you to find a string within a string (using the POS function), but how to find a string within an ar-

■ TURBO POWER USER


```
{$R+,C-}
TYPE
    str255 = STRING[255];
    bigarray = ARRAY[1..32767] OF Char;
VAR
    buffer : BigArray;
    search : str255;
    result : Integer;

FUNCTION pos_array(buffer : BigArray; start : Integer;
                   finish : Integer; what : str255) : Integer;

(* To make the function ignore upper/lower CASE distinctions,
   find each occurrence of the marker "(uc)" and replace it
   with the TURBO function "UpCase" *)

VAR
    found  : Boolean;
    L      : Byte;
    rest, P : Integer;
BEGIN
    found := False;
    L := Length(what);
    WHILE (found = false) AND ((start < finish-L) AND (start > -1)) DO
    BEGIN
        start := start+L;
        rest := 1;
        WHILE Pos((uc)(buffer[start]), Copy(what, rest+1, L-rest)) = 0 DO
        BEGIN
            rest := rest+Pos((uc)(buffer[start]), Copy(what, rest+1, L-rest));
            start := start-rest+1;
            P := P-1;
            REPEAT
                P := P-1;
            UNTIL (uc)(what[P]) <> (uc)(buffer[start+P-1]);
            IF P > L THEN
                found := True
            ELSE start := start-rest+1;
        END;                         {if rest > 0 then}
    END;                             {while (found=false) and (start<finish) do}
    IF found THEN pos_array := start ELSE pos_array := 0;
END;                                 {procedure pos_array}

PROCEDURE test(S : str255);
    PROCEDURE explain(R : Integer);
    BEGIN
        IF R > 0 THEN
            WriteLn('Found string at position ', R)
        ELSE
            WriteLn('String is not present');
    END;

BEGIN
    WriteLn;
    WriteLn('Searching for "', S, '"');
    Write('POS_ARRAY:  ');
    result := pos_array(buffer, 0, 32767, S);
    explain(result);
END;

BEGIN
    FillChar(buffer, SizeOf(buffer), #0);
    search := 'Now is the tiny'; { Search string }
    Move(search[1], buffer[1000], Length(search));
    test(search);
    test('The quick brown fox');
    test('DOG');
END.
```

Figure 2: A program to demonstrate Pos_Array.

ray? I wrote the Pos_Array function in Figure 2 to search a large character array for a particular string as I was growing up in Wisconsin.

John P. Thien
Milwaukee, Wisconsin

Mr. Thien's clever algorithm is faster for long strings than it is for short ones. If you are looking for a string of length L,

Pos_Array checks every Lth character in the buffer. If that character is contained in the target string, Pos_Array uses its position in the target to note where the target would have had to start for that particular character to fall where it did. If it does not find the target string starting at that point, it tries again.

For comparison, I timed Pos_Array

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PRODUCTIVITY

■ TURBO POWER USER

```
Searching for "Now is the time"
POS_ARRAY: 0.66 seconds to find string at position 10000
DUMBPOS:   1.32 seconds to find string at position 10000
BLOCKPOS:  0.06 seconds to find string at position 10000

Searching for "the quick brown fox"
POS_ARRAY: 1.81 seconds to find that string is not present
DUMBPOS:   4.20 seconds to find that string is not present
BLOCKPOS:  0.06 seconds to find that string is not present

Searching for "DOG"
POS_ARRAY: 5.27 seconds to find that string is not present
DUMBPOS:   4.20 seconds to find that string is not present
BLOCKPOS:  0.05 seconds to find that string is not present
```

Figure 3: *Comparative times for the three POS routines.*

```
Program Conin;
[by Neil J. Rubenking]
TYPE
    regpack = RECORD
                CASE Boolean OF
                  True : (AX, BX, CX, DX, BP, SI, DS, DI, ES, FLAGS : Integer);
                  False : (AL, AH, BL, BH, CL, CH, DL, DH : Byte);
              END;
    char_set = set of char;
CONST
    range    : char_set = [#0..#255];
    special  : char_set = [#13,#0];
    AutoUpCase : boolean = false;
VAR
    rega     : regpack;
    Line     : string[80];
    StorePtr : integer;
    Itg      : integer;
    CCH      : integer;

    function ConIn : char;
    var myCH : char;
    BEGIN
        WITH rega DO
            BEGIN
                repeat
                    AH := 8;
                    MSDOS(rega);
                    myCH := chr(AL);
                until myCH in (range + special);
            END;
        IF AutoUpCase THEN myCH := UpCase(myCH);
        conin := myCH;
    END;

BEGIN
    ClrScr;
    StorePtr := ConInPtr;
    ConInPtr := ofs(ConIn);
    AutoUpCase := true;
    WriteLn('Enter a line -- regardless of shift keys, it will be upper case');
    ReadLn(Line);
    AutoUpCase := false;
    WriteLn('Enter a line -- now you can enter only numbers');
    range := ['0'..'9'];
    ReadLn(Line);
    WriteLn('Now a "read(Kbd,ch)" -- but only a number key will do.');
    Read(Kbd,CCH); writeln(CCH);
    WriteLn('Now enter an integer.  Only number keys respond, but you can');
    WriteLn(' get out of integer range. ');
    ReadLn(Itg);
    WriteLn(Itg,' / 10 = ',Itg div 10);
    WriteLn('Now you can enter alphabetic keys only -- try it.');
    range := ['a'..'z','A'..'Z'];
    ReadLn(Line);
    ConInPtr := StorePtr;
END.
```

Figure 4: *You can modify Turbo's* Read *and* ReadLn *procedures by changing their* ConsoleInput *routine.*

against a "dumb" search routine and an INLINE routine. The results are shown in Figure 3. DumbPos simply scans through the array until it finds a match for the first character of the target string. Then it attempts to match each character of the target in turn. BlockPos, the INLINE routine, works exactly like DumbPos but is immensely faster.

Space considerations preclude listing the "dumb" routine and the INLINE routines themselves, though they are available as part of POSARRAY.PAS through the PC Magazine Interactive Reader Service.

INTERACTIVE INPUT

If your programs handle input interactively, you have to protect them from their users. Otherwise, someone will undoubtedly type "dog" where an integer was expected and crash the program. One protective measure is simply to disallow inappropriate keystrokes. You could do this by read-

■ **If your programs handle input interactively, you have to protect them from their users.**

ing one character at a time and processing each character within your program, but there's an easier way.

Part of the power of Turbo's Read procedure is that it can take any number of arguments of many different types. You can't write procedures with this quality, but you can affect how Read gets its input. Borland has made it easy. The standard identifier ConInPtr is an offset within the code segment of the Console Input routine used by Read. If you set ConInPtr to the offset of a function of your own that gets input and returns a character, you will have control over the characters Read receives.

The function ConIn in Figure 4 is such a routine. It keeps reading characters from the keyboard, using interrupt DOS until it receives one that is in the set Range. You

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The sample screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering titles, changing options, getting "help" and so on.

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TEXT/MESSAGE WINDOW used to enter user text and to display messages from Interactive EasyFlow.

CURRENT SHAPE WINDOW - shows the content of the current flowchart shape (the one under the SHAPE CURSOR) in complete detail.

CHART WINDOW gives an overview of your chart; this example shows the "normal" view. "Close-up" view shows a smaller part of the chart in more detail. "Wide-angle" view shows a larger part of the chart at reduced size.

SHAPE CURSOR shows where you are in the chart. Cursor keys move it around; chart window scrolls if you run off the edge of the window

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---

can control input by changing the value of *Range*. Also, if the Boolean flag *AutoUp-Case* is true, all input characters will be forced into uppercase. You can build on this simple example.

EASY LISTING

Most Turbo users seem to think that they must exit Turbo in order to list a program. Since DOS treats LPT1 like a file, however, you can simply mark your program (or any part of it) as a block and `^KW` (write

■ **Most users think they must exit Turbo to list a program. Simply mark it as a block, `^KW` to LPT1, and it will go to the printer.**

block to file) to LPT1. It will go to the printer. Note that Turbo will ask "overwrite?"; just answer "Y".

Bruce Gilham
Los Angeles, California

You can also write to PRN. Note, however, that many printers don't print a line until they get a carriage return. Furthermore, to avoid losing the last line of your block, be sure to mark the block's end at the beginning of the next line.

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Neil J. Rubenking is a professional Pascal programmer.

■ PAUL SOMERSON

USER-TO-USER

Speed up disk accesses, smarten up print screens, shut down unwanted key repeats, and recover from irritating copy-protection problems.

THREE COMS

DOS can use all the help it can get. I wrote three small assembly language programs to help smooth out three separate problems:

(1) If you use your PC's floppy disk drives frequently, you probably spend a lot of time waiting for the disks to stop spinning so you can safely switch them. The memory-resident FASTOFF.COM program turns off the drive motor much more quickly than the standard IBM PC does. Normally the motors are turned off 37 ticks (about 2 seconds) after the last disk access. FASTOFF reduces this time by decrementing the elapsed time counter twice as fast as normal.

A single byte located in the ROM data area is used to maintain the number of ticks remaining before the motor will be turned off. Part of the system timer's job is to decrement this byte and turn off the drive motor when the counter reaches zero. FASTOFF uses the timer tick interrupt, which occurs 18.2 times each second, to decrement this same counter. Since this program addresses the ROM-BIOS data area, it will work on an IBM or a very close compatible only.

(2) It seems that after every print screen, the next step is always to take the printer off-line and press the form feed to eject the page. The memory-resident FFEED program will add a form feed character automatically after the print screen operation is complete. Since at times the form feed is undesirable, FFEED adds it only if the Right Shift key was used with PrtSc.

It works by intercepting interrupt 5, which occurs whenever the keyboard detects a Shift-PrtSc. It then tests the keyboard status to see which shift key is being held down. If it is the right one, then the FF character is sent to the printer when the screen dump completes.

FFEED is also smart enough to check to see if the printer is on-line and ready before beginning the screen print. If the printer is

```
;   FASTOFF.ASM - TURNS OFF DISKETTE DRIVE MOTOR MUCH QUICKER
;   ======================================================================
BIOS_SEG          SEGMENT AT 40H                    ;ESTABLISH BIOS SEG
                  ASSUME CS:BIOS_SEG
                  ORG    0040H
MOTOR_COUNT:      DB     ?
BIOS_SEG          ENDS
;
CSEG   SEGMENT
                  ASSUME CS:CSEG
ROM_INT8          DD     ?                           ;ORIGINAL TIMER INTERRUPT VECTOR ADDRESS
                  ORG    100H
START:            JMP    SHORT INITIALIZE
;   ======================================================================
INT8   PROC   FAR
                  PUSH   DS
                  PUSH   AX
                  MOV    AX,BIOS_SEG                  ;ESTABLISH BIOS DATA SEGMENT
                  MOV    DS,AX                        ;ADDRESSABILITY.
;
                  CMP BYTE PTR MOTOR_COUNT,0          ;IS IT ALREADY DOWN TO ONE
                  JB     RETURN                       ;IF YES, LEAVE IT ALONE
                  DEC BYTE PTR MOTOR_COUNT            ;IF NOT, DECREMENT IT
;
RETURN:           POP    AX
                  POP    DS
                  JMP    ROM_INT8                     ;JUMP TO ORIGINAL TIMER ROUTINE
INT8   ENDP
;   ======================================================================
INITIALIZE:
                  ASSUME CS:CSEG, DS:CSEG
;
                  MOV    AX,3508H                     ;SETUP TO GET OLD VECTOR
                  INT    21H
                  MOV WORD PTR [ROM_INT8]  ,BX        ;SAVE OLD VECTOR OFFSET
                  MOV WORD PTR [ROM_INT8+2],ES        ;SAVE OLD VECTOR SEGMENT
;
                  MOV    DX,OFFSET INT8               ;SETUP TO CHANGE VECTOR
                  MOV    AX,2508H
                  INT    21H
;
                  MOV    DX,OFFSET INITIALIZE         ;POINT TO END OF CODE WE NEED TO KEEP
                  MOV    DX,27H                       ;AND TERMINATE SETUP OPERATION.
CSEG   ENDS
                  END    START
```

Figure 1: *Assembler source code for FASTOFF.COM.*

■ USER-TO-USER

not ready, the screen dump is aborted to prevent the keyboard from locking up. This is done by making a printer status call before giving control to the ROM routine. It's odd that such a simple check was not included within the standard ROM routine.

(3) For a young child or an inexperienced typist, the auto-repeat feature of most keyboards may cause lots of unwanted duplicate keystrokes. The memory-resident NOREPEAT program eliminates the auto-repeat no matter how long a key is held down.

It works by using interrupt 9 to examine each keystroke. Normally this detects when each key is depressed and when it's released. When a key is held down long enough to repeat, the keyboard simulates

> ■ NOREPEAT senses these unwanted duplicate keystrokes and then prevents them from being inserted into the keyboard buffer.

the key's being depressed again and again without being released. NOREPEAT senses these unwanted duplicate keystrokes and then prevents them from being inserted into the keyboard buffer. When the key is finally released, new keystrokes are again allowed to occur normally.

You can create these three .COM files by typing in the assembly language listings in Figures 1, 2, and 3, and then running them through the assembler and EXE2BIN.

Tom Kihlken
St. John, Missouri

These three programs are so short and sweet that we combined them into one master BASIC program (see Figure 4) that creates the trio. But heed Mr. Kihlken's caveat about experimenting with disk drive parameters on non-IBM systems!

Figure 2: Assembler source code for FFEED.COM.

Figure 3: Assembler source code for NOREPEAT.COM.

(continues)

■ USER-TO-USER

```
        ;
        MOV     CS:LAST_KEY,AL    ;NOW THIS BECOMES THE LAST KEY
        POP     AX                ;RESTORE THE STACK
        JMP     CS:[OLDINT9]      ;ALLOW THE ROM TO PROCESS THE KEY
        ;
IGNORE: IN      AL,61H            ;GET KEYBOARD STATUS
        MOV     AH,AL
        OR      AL,80H            ;RESET KEYBOARD
        OUT     61H,AL            ;SET BACK ORIGINAL KEYBOARD STATUS
        XCHG    AL,AH
        OUT     61H,AL            ;RESTORE KEYBOARD STATUS
        ;
        MOV     AL,20H
        OUT     20H,AL            ;RESET INTERRUPT CONTROLLER
        ;
        POP     AX
        IRET                      ;RETURN FROM INTERRUPT
        ;
; PROGRAM INSTALLATION
        ;
        ASSUME  DS:CSEG
INITIALIZE:
        MOV     AX,3509H          ;SETUP TO GET OLD INT9 VECTOR
        INT     21H
        MOV     WORD PTR [OLDINT9], BX
        MOV     WORD PTR [OLDINT9+2],ES
        ;
        MOV     DX, OFFSET REWINTS ;SETUP TO CHANGE VECTOR
        MOV     AX, 2509H         ;DOS FUNCTION TO CHANGE VECTOR
        INT     21H
        ;
        MOV     DX, OFFSET INITIALIZE ;BYTES TO STAY RESIDENT
        INT     27H               ;TENINATE AND STAY RESIDENT
        ;
CSEG    ENDS
        END     START
```

(Figure 3 ends)

```
100 ' Program to create FFEED.COM, FASTOFF.COM, NOREPEAT.COM
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 14:FOR C=1 TO 17:READ A$:IF C<17 THEN 140
130 S=S+VAL(A$)
140 NEXT:NEXT
150 IF S=17402 THEN RESTORE:GOTO 180
160 PRINT "ERROR:  CHECK THE LAST NUMBER IN"
170 PRINT "EACH DATA STATEMENT-- THEN REDO":END
180 FOR B=1 TO 14:FOR C=1 TO 16:READ A$:TTL=TTL+VAL("&H"+A$)
190 NEXT
200 READ S:IF S=TTL THEN 220
210 PRINT "DATA ERROR IN LINE";B*10+340;"-- REDO":END
220 TTL=0:NEXT:RESTORE
230 OPEN "FFEED.COM" AS #1 LEN=1:FIELD #1,1 AS D$
240 FOR B=1 TO 14:FOR C=1 TO 16:READ A$
250 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
260 CLOSE:PRINT "FFEED.COM CREATED"
270 OPEN "FASTOFF.COM" AS #1 LEN=1:FIELD #1,1 AS D$
280 FOR B=1 TO 4:FOR C=1 TO 16:READ A$
290 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
300 CLOSE:PRINT "FASTOFF.COM CREATED"
310 OPEN "NOREPEAT.COM" AS #1 LEN=1:FIELD #1,1 AS D$
320 FOR B=1 TO 9:FOR C=1 TO 16:READ A$
330 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
340 CLOSE:PRINT "NOREPEAT.COM CREATED"
350 DATA E8,30,00,00,00,00,00,F5,50,52,B4,02,BA,09,00,CD,17,1292
360 DATA F6,C4,00,74,1A,B4,02,CD,16,24,01,8A,D8,9C,2E,FF,1943
370 DATA 1E,02,01,8A,F9,00,74,07,B4,00,CD,33,D2,CD,17,5A,1389
380 DATA 5B,C7,86,85,35,CD,21,89,18,02,81,8C,06,04,01,8A,1282
390 DATA 06,81,B8,05,25,CD,21,8A,32,81,CD,27,08,40,00,04,1234
400 DATA 00,87,72,84,FE,80,40,00,18,58,00,40,00,8E,D8,80,16,48,1234
410 DATA 00,82,72,84,FE,80,40,00,58,1E,2E,FF,2E,02,01,88,1105
420 DATA 89,35,CD,21,89,18,02,81,8C,06,04,01,BA,06,01,B8,987
430 DATA 25,CD,21,8A,32,81,CD,27,08,40,00,00,00,80,80,78,745
440 DATA EB,2C,00,00,00,00,00,FF,FB,50,E4,60,22,56,86,01,1386
450 DATA 74,04,28,42,3C,08,74,10,FF,28,02,01,8A,61,8A,5B,2B,1046
460 DATA 0C,80,E6,61,86,C4,E6,61,B8,20,00,E6,20,58,CF,B8,892
470 DATA 35,CD,21,89,18,02,81,0C,06,04,01,BA,07,01,86,09,959
480 DATA 25,CD,21,8A,32,81,CD,27,00,00,00,00,00,00,00,752
```

Figure 4: *Master KIHLKEN.BAS BASIC program to create FASTOFF.COM, FFEED.COM, and NOREPEAT.COM.*

NO BYTES

Two fellow employees recently asked me how they could create a file 0 bytes long. They had accidentally deleted a similar file that was apparently part of a copy-protection scheme that required a zero-length file called XS.SYS.

The trick is to create the filename without a file. At first I thought it could be copied from the original disk, but most utilities can't copy a 0-byte file. I decided to create just the filename with no real file. After many failures, and completely by accident, I tried to redirect the output of a batch file to the XS.SYS file and it worked.

Use any .BAT file you happen to have handy, or create one by typing the following two lines, hitting the Enter key after each, and hitting the F6 key and then the Enter key when you're done:

```
COPY CON: TEST.BAT
GO
```

Then type

```
TEST > XS.SYS
```

(If you use the TEST.BAT batch file above, you should get a "Bad filename" or "File not found" message; ignore it.)

Now issue a DIR command and you'll get a listing for XS.SYS that is 0 bytes long.

Robert T. Collina
Lake Hopatcong, New Jersey

There's a far easier way to create a zero-length file named XS.SYS. Make sure DEBUG.COM is on your disk and type:

```
DEBUG XY.SYS
W
Q
```

(Again, ignore the "File not found" message.) Sigh. The things vendors do to try to make it hard for users.

SHARE YOUR DISCOVERIES

Tell fellow users about your latest discovery through User-to-User, and we'll pay you between $50 and $300 if published, plus an extra $25 if you submit it on a disk. If you send a disk, please include a printout to ensure against damage in transit. Mail your contributions to User-to-User, PC Magazine, One Park Avenue, New York, NY 10016

■ CHARLES PETZOLD

PC TUTOR

Serial dates via Turbo, eliminating double line feeds on a daisy wheel, dangerous debugging of hard disk directories, and new and old .EXE formats.

DIFFERENCES BETWEEN DATES

In Turbo Pascal I have used the interrupt $21 function call $2A to get the date from the system clock. This function call returns the year in register CX, the month in DH, and the day of the month in DL. In order to calculate the number of days between the current date and a fixed date, however, I need to retrieve the date in the *1-2-3* format, i.e., where January 1, 1900, is 1 and December 31, 2099, is 73050.

Does the date in this format reside somewhere in my system where I can access it in Turbo Pascal?

Greg Schulte
Springfield, Virginia

No. Lotus's representation of the date in this "serial number" format (as the manuals call it) is internal to 1-2-3. DOS does not provide this information. Even if 1-2-3 could get it from DOS, it would still have to convert older dates to the same format.

It's easy enough to write a Turbo Pascal function to convert a day, month, and year to a serial date, however. The only really uneasy part of any date conversion function is dealing with leap years. As we know, years divisible by 4 are leap years, except for years divisible by 100, which are not leap years, except for years divisible by 400, which are. So 1900 is not a leap year, but 2000 is. Interestingly enough, 1-2-3 treats 1900 as a leap year. If you really want Lotus-compatibility, you'll have to be consistent. (Like parents, standards are right even when they're wrong.)

A demo program with this conversion function is shown in Figure 1.

EXEMPLARY? EXECRABLE?

While I know that the extension .COM designates a "command" file, in the 4 years I've used an IBM PC I have never found out what the .EXE extension stands for. Please tell me.

Richard L. Watson
Affton, Missouri

Oddly enough, although I searched my entire collection of IBM and Microsoft manuals exhaustively, I found no clear statement about the meaning of .EXE. This must be one of those undocumented features of DOS that people are always talking about.

The .COM file extension comes from CP/M (now called CP/M-80, since it became an operating system for the 8080 microprocessor). PC-DOS 1.0 and 1.1 were heavily CP/M-based. In fact, the .COM file formats of CP/M and PC-DOS (includ-

ing the Program Segment Prefix that DOS builds when it loads a .COM file) are virtually identical. For software developers, this similarity helped ease the transition to the PC. Programmers could ignore the 8086 segment registers and have access to 64K of program and data space, just as they had had under CP/M.

The .EXE format is native to PC-DOS and can support program files larger than 64K. It does this by allowing different segments to be defined for code, data, and the stack, each of which can be 64K long. Programs in .EXE format may contain explicit references to segment addresses. A header in the .EXE file has relocation information that DOS uses to resolve these references.

The .COM file format will eventually be phased out as DOS evolves, and the .EXE format will undergo some changes. Indeed, there are actually two .EXE file formats already. The "old" format is docu-

```
program DateDemo;

function SerialDate (year, month, day: integer) : real ;
    const monthday : array [1..12] of integer =
        (0,31,59,90,120,151,181,212,243,273,304,334);
    var  sdate : real ;
    begin
        sdate := 365.0 * year + (year + 3) div 4 ;
        if ((year mod 4 = 0) and (month > 2)) then
            sdate := sdate + 1 ;
        SerialDate := sdate + monthday [month] + day ;
    end ;

begin
    Writeln ('Jan. 1, 1900 is serial date', SerialDate (0, 1, 1):6:0) ;
    Writeln ('Feb. 25, 1987 is serial date', SerialDate (87, 2, 25):6:0) ;
    Writeln ('Dec. 31, 2099 is serial date', SerialDate (199, 12, 31):6:0) ;
end.
```

Figure 1: *A Turbo Pascal program with a function that converts a year, month, and day between 1900 and 2099 to the serial date used by 1-2-3. This reproduces a 1-2-3 error in assuming that 1900 is a leap year.*

mented in the DOS Technical Reference manuals and has remained the same over the years. The "new" .EXE format puts more information in the header section and is currently used in applications that run under Microsoft Windows. Microsoft seems to be indicating that this new .EXE format will also be used for programs that can run under 80286 protected mode in a future version of DOS. (The linker that

● The "new" .EXE format puts more information in the header section and is used in applications that run under *Windows.*

comes with the Windows Software Development Kit to create these new .EXE files is called LINK4.)

The two .EXE formats are related, as you'll see if you execute a Microsoft Windows application under the current versions of DOS. DOS doesn't know anything about the new .EXE format, so it ends up executing a separate tiny program (imbedded in the .EXE file) that simply prints the message "This program requires Microsoft Windows" and terminates. Windows, however, knows that the header has more information and can thus determine where the real program actually begins (as well as many other things).

This bit of compatibility between the old and new .EXE formats is rather clever because the Windows application doesn't actually have to check that it's running under Windows. DOS executes the tiny imbedded program simply because of its knowledge of the structure of .EXE files. Cute, isn't it?

Oh, by the way, .EXE stands for "executable"—whether it's documented that way or not.

DEBUG AND DISK SECTORS

The article "Keeping Your Files Private" (*PC Magazine*, Volume 5 Number 16) describes how DEBUG can be used to turn

PRODUCTIVITY

■ PC TUTOR

on the "hidden" attribute of a file or directory on a floppy disk. How can I modify this command if I want to hide a directory on my hard disk?

Ed Guttman
Canton, Michigan

I do not recommend using DEBUG to alter directory information. It's not so bad with a floppy disk because the worst that can happen is that you lose 360K of data. With a hard disk, however, you could lose . . . well, how big is your hard disk? There is just too much that could go wrong when you use the DEBUG L and W commands to modify disk sectors.

Even if I wanted to give you the DEBUG command that would load and write the hard disk directory, I could not tell you the sector where the root directory begins. For hard disks, the root directory does not begin a specific sector. Its starting point depends upon the size of the hard disk, the size of the DOS partition, and whether the file allocation table contains 12-bit or 16-bit cluster entries.

The DOS function call that reports the starting sector of the root directory has not been documented by Microsoft. (However, readers interested in some unofficial documentation of this function call can consult "Diskscan Finds Bad Sectors" in the Programming/Utilities column of PC Magazine, Volume 5 Number 8.)

Even with this information, however, you can find the location of only the root directory. Subdirectories may be anywhere on the hard disk. You would have to find the starting cluster number of the subdirectory from the root directory, convert that to a sector number, and then load that sector into DEBUG.

As the Editor's Note in the "Keeping Your Files Private" article indicates, a much better method for changing file attributes is ATTR, a program presented in Volume 5 Number 11 and available on the PC Magazine Interactive Reader Service bulletin board. You can download the program for your own use without charge, via modem, by calling (212) 696-0360.

If I've convinced you not to use DEBUG for this job, you definitely do not want to read the following few paragraphs. I'm going to tell you how to do something that I don't want you to do.

■ PC TUTOR

To modify the root directory on a hard disk directly, you must first determine the location of the root directory. You can do this with information from the boot sector, which is sector 0. (This information may not appear on a disk that is not bootable or that uses its own driver files.) Load sector 0 of the hard disk into DEBUG with

    L 100 2 0 1

The 100 is the memory address where the sector is to be loaded, 2 refers to drive C, 0 means sector 0, and 1 means "read 1 sector."

Now do a DEBUG D command. The 2 bytes at offset 10Eh are the number of "reserved sectors" and will probably be 1. (Remember to switch the order of the 2 bytes to convert them into a word.) The single byte at offset 110h is the number of the file allocation tables (FATs). This will probably be 2. The 2 bytes at offset 116h contain the number of sectors per FAT. On my 30-megabyte hard disk this is 3Dh, or 59 in decimal. (Your hard disk may be different.) Multiply the number of FATs by the number of sectors per FAT. Add the number of reserved sectors. For my hard disk, that comes out to 7Bh. That is the sector where the root directory begins.

The size of the root directory can be calculated just as easily, though remember I told you that you don't want to do this. The number of root directory entries is the word at offset 111h. For most hard disks, this will equal 200h, or 512 decimal. Multiply this by 20h (32 decimal), which is the number of bytes per directory entry. That comes out to 4000h, which is 32,768 in decimal. Now divide that number by the bytes per sector, which is the word at offset 10Bh and should be 200h (512 bytes). The result is 20h (32 decimal) sectors for the length of the root directory.

(The information on the layout of the boot sector is documented in the DOS Technical Reference manual in the section on device drivers.)

You can load the root directory into DEBUG with the command

    L 100 2 7B 20

You should use the number you calculated for the starting sector of your root directory instead of the 7B above, and the number

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■ PC TUTOR

you calculated for the length of your root directory instead of my 20. After you do this you can see your entire root directory by executing

    D 100 L 4000

If you're still with me here, you can follow the directions given in "Keeping Your Files Private" for modifying the attribute byte of a file or directory. When you're done, take a deep breath and type carefully

    W 100 2 7B 20

again substituting your own calculated values for the 7B and 20. Notice that the W and L commands shown here use the same parameters. That's the easiest and safest way to make sure that what you loaded from the disk gets written back to the same place.

Again I emphasize that using DEBUG to modify any disk directly is dangerous if you value the data on the disk. If you try it anyway and mess up your disk, it's your own fault. [Besides, ATTR.COM does the job much more easily.—Ed.]

USING THE TANDY DAISY WHEEL II

Several readers have let me know that there is a better way to prevent the double line feed problems when using the Tandy Daisy Wheel II (PC Tutor, Volume 5 Number 17). The printer has a control sequence to turn auto-line-feeding off. You can do it in BASIC with the statement

    LPRINT CHR$(27) + CHR$(21)
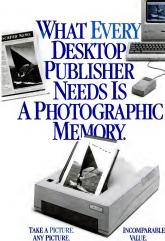
One reader said that Radio Shack has an LPDRVR.SYS driver that fixes the problem. Either solution is simple enough, but it's not the whole story. A Daisy Wheel II with a serial number before 13010163 requires a new ROM chip (part number AMX-4805-26-1158, $30) before this control sequence will work.

I thank everybody who wrote me about this and I'm glad there's a better way around the problem than the kludgy solution I came up with.

ASK THE PC TUTOR

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■ **PC PRODUCT INDEX**

PC MAGAZINE

COMING UP

EGA AND MULTISCAN MONITORS
In the year since our last color monitor roundup, new EGA and multiscan monitors have proliferated at an amazing rate. The NEC MultiSync, once the unchallenged King of the Hill, is meeting some stiff competition. We review 17 of the strongest challengers.

SMALL-FOOTPRINT PCs The thinking used to be that if your PC didn't look like an IBM it couldn't be as good, and if it was smaller than an IBM, forget it. These days, good things are coming in smaller packages. Winn L. Rosch looks at small-footprint computers, both PC and AT class, from Tandy, Hewlett-Packard, Epson, Olivetti, TeleVideo, Leading Edge, and PC's Limited.

MAILING-LIST MANAGERS Getting rid of the drudgery of maintaining mailing lists is the job of these 25 programs, ranging in price from $12 to $295. Barbara Krasnoff and Bruce Brown put them to the test.

REMOTE COMMUNICATIONS M. David Stone looks at *Carbon Copy*, *PC Anywhere*, *Remote*, and *Close-Up* — communications software that lets you operate your PC remotely or run the same program at two sites simultaneously.

EMULATING EXPANDED MEMORY
You don't necessarily have to buy an expensive expanded memory board to make room for those extra-large spreadsheets. Charles Petzold reviews five programs that can emulate expanded memory, and all of them do it for less than $90.

THE INVISIBLE NETWORK Frank J. Derfler, Jr.'s year-long connectivity series continues with a comprehensive review of Invisible Software's Invisible Network system and a comparison of its merits with those of AT&T's StarLAN and Fox Research's 10-NET.

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